THE COMPLETE LINE

UNITED STATES RADIATOR CORPORATION

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Foreword

AGAIN we present another issue, the sixth, of our catalog illustrating our product, and containing reference matter and engineering data of interest to the designer of heating systems.

The boilers and radiators illustrated herein are made in factories equipped with every known device for producing castings of great strength and durability. Their progress through the various factory departments is under careful supervision and rigid inspection conducted by a testing department independent of the plant management. Methods not used by other manufacturers are employed, irrespective of cost, to insure a superior product.

The engineering data herein is compiled from the best authorities of this and other countries, supported by investigations of our own experimental department, and of engineering colleges under our direction. This information is appended to the catalog of our product to make a handy reference book for the convenience of our patrons and the heating trade in general.

Our wide distribution of manufacturing plants, together with distributing warehouses in the principal shipping centers, enable us to ship to every section of the country at low freight rates, and with little delay in transit.

Our facilities are at your service.

Yours very truly,

UNITED STATES RADIATOR CORPORATION

Detroit, Mich.

July 1, 1920

Prices herein supersede all former lists, and are subject to change without notice. Discounts quoted to regular trade only.

Guarantee

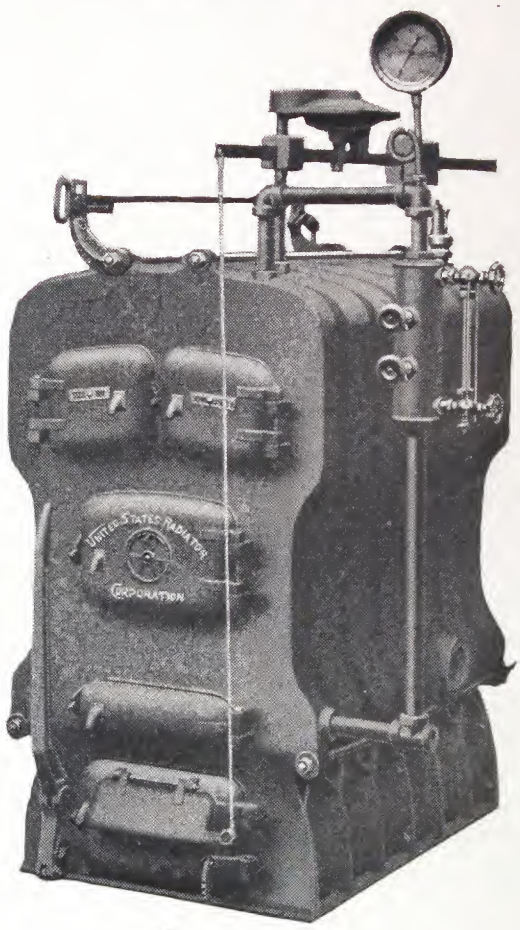
*We absolutely guarantee the published capacities of CAPITOL BOILERS in pounds of steam at the boiler outlet, provided that the area of the vertical smoke flue and its height shall be great enough to provide a sufficient draft to consume with proper combustion the required amount of fuel per hour, and the best grades of *anthracite coal are used.*

See Basis of Ratings, Page 189

* Owing to the wide variation in the heating value of bituminous coals in the United States, which run from 9,000 to 15,000 B. T. U's per pound, it is impractical to guarantee the evaporation or the ratings of boilers when bituminous fuels are used, unless an analysis of the fuel is available.

We do not recommend the use of a pipe coil or cast iron section in the fire pot for hot water supply, but advise the use of a separate water heater.

180 Series



187 Steam

187 Water

Steam

No.	*8-Hour Rating Square Feet	Price List	Coal Capacity Cu. Ft.	Minimum Chimney Height Feet	Minimum Chimney Dimensions Inches	Outlets and Inlets
184	400	$208.00	2.33	35	8x 8	2–3″
185	550	245.00	3.17	35	8x12	2–3″
186	700	310.00	4.01	35	8x12	2–3″
187	850	355.00	4.84	40	8x12	2–3″

Inclusive of trimmings—HEIGHT, 65 inches; WIDTH, 36¾ inches.
Height of Water Line, 40½ inches.

Water

184	650	$198.00	2.33	35	8x 8	2–3″
185	910	235.00	3.17	35	8x12	2–3″
186	1170	300.00	4.01	35	8x12	2–3″
187	1430	345.00	4.84	40	8x12	2–3″

For smoke pipe, base dimensions and other measurements, see page 20.
Do not bush flow pipe outlets—connect them full size to the mains.
Use a larger boiler for soft coal.
For wood-burning boilers, fire door 15¾″ x 11″ can be furnished on boilers shipped from factory.

Basis Used for Establishing Ratings

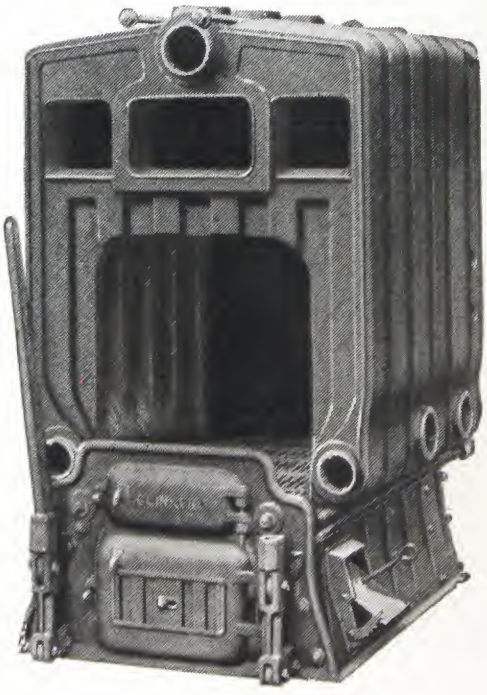
(Result of Laboratory Tests)

No.	Adequate Fuel (Anthracite) Lbs.	Recharging Reserve Lbs.	Fuel Consumed Lbs.	Evaporation per Lb. Fuel Lbs.	Total Steam Capacity Lbs.	*8-Hour Rating Square Feet
184	119	24	95	8.5	800	400
185	163	33	130	8.5	1100	550
186	207	42	165	8.5	1400	700
187	250	50	200	8.5	1700	850

When fuel is consumed in shorter or longer period the hourly capacity is proportionately increased or decreased.
To establish 8-hour steam rating in square feet, divide the total steam capacity in pounds by eight and divide by 0.25.
To determine hourly potential energy in B. T. U. divide total steam capacity by eight and multiply by 970.
Hourly potential energy in B. T. U., divided by 240 for steam and 150 for water, gives 8-hour rating.
***See Basis of Boiler Ratings, page 189.**

200 Series

207 Steam



207 Water

Steam

No.	*8-Hour Rating Square Feet	Price List	Coal Capacity Cu. Ft.	Minimum Chimney Height Feet	Minimum Chimney Dimensions Inches	Outlets and Inlets
204	600	$259.00	4.36	35	8x12	2–3″
205	800	340.00	5.85	35	8x12	2–3″
206	1000	400.00	7.34	35	8x12	2–3″
207	1200	460.00	8.83	40	8x12	3–3″

Inclusive of trimmings—HEIGHT, 70 inches; WIDTH, 45 inches.
Height of Water Line, 46½ inches.

Water

204	1000	$249.00	4.36	35	8x12	2–3″
205	1300	330.00	5.85	35	8x12	2–3″
206	1650	390.00	7.34	35	8x12	2–3″
207	2000	450.00	8.83	40	8x12	3–3″

For smoke pipe, base dimensions and other measurements, see page 20.
Do not bush flow pipe outlets—connect them full size to the mains.
Use a larger boiler for soft coal.

Basis Used for Establishing Ratings

(Result of Laboratory Tests)

No.	Adequate Fuel (Anthracite) Lbs.	Recharging Reserve Lbs.	Fuel Consumed Lbs.	Evaporation per Lb. Fuel Lbs.	Total Steam Capacity Lbs.	*8-Hour Rating Square Feet
204	178	36	142	8.5	1200	600
205	237	48	189	8.5	1600	800
206	295	59	236	8.5	2000	1000
207	354	71	283	8.5	2400	1200

When fuel is consumed in shorter or longer period the hourly capacity is proportionately increased or decreased.

To establish 8-hour steam rating in square feet, divide the total steam capacity in pounds by eight and divide by 0.25.

To determine hourly potential energy in B. T. U. divide total steam capacity by eight and multiply by 970.

Hourly potential energy in B. T. U., divided by 240 for steam and 150 for water, gives 8-hour rating.

***See Basis of Boiler Ratings, page 189.**

250 Series

257 Steam

257 Water

Steam

No.	*8-Hour Rating Square Feet	Price List	Coal Capacity Cu. Ft.	Minimum Chimney Height Feet	Minimum Chimney Dimensions Inches	Outlets and Inlets
255	1100	$430.00	8.37	40	8x12	2–4″
256	1350	505.00	10.45	40	8x12	2–4″
257	1600	580.00	12.53	40	12x12	3–4″
258	1850	655.00	14.62	45	12x12	3–4″

Inclusive of trimmings—HEIGHT, 73 inches; WIDTH, 51½ inches.
Height of Water Line, 49 inches.

Water

255	1825	$420.00	8.37	40	8x12	2–4″
256	2225	495.00	10.45	40	8x12	2–4″
257	2650	570.00	12.53	40	12x12	3–4″
258	3050	645.00	14.62	45	12x12	3–4″

For smoke pipe, base dimensions and other measurements, see page 20.
Do not bush flow pipe outlets—connect them full size to the mains.
Use a larger boiler for soft coal.
For wood burning boilers, fire door 21″ x 11¾″ can be furnished on boilers shipped from factory.

Basis Used for Establishing Ratings

(Result of Laboratory Tests)

No.	Adequate Fuel (Anthracite) Lbs.	Recharging Reserve Lbs.	Fuel Consumed Lbs.	Evaporation per Lb. Fuel Lbs.	Total Steam Capacity Lbs.	*8-Hour Rating Square Feet
255	313	63	250	8.8	2200	1100
256	384	77	307	8.8	2700	1350
257	455	91	364	8.8	3200	1600
258	526	105	421	8.8	3700	1850

When fuel is consumed in shorter or longer period, the hourly capacity is proportionately increased or decreased.
To establish 8-hour steam rating in square feet, divide the total steam capacity in pounds by eight and divide by 0.25.
To determine hourly potential energy in B. T. U., divide total steam capacity by eight and multiply by 970.
Hourly potential energy in B. T. U., divided by 240 for steam and 150 for water, gives 8-hour rating.
When thought necessary on account of draft conditions, the length of grate can be reduced by taking out one or more grate bars and filling in with fire brick.
*See Basis of Boiler Ratings, page 189.

G-270 Series

G 278 Steam

G 278 Water

Steam

No.	*8-Hour Rating Square Feet	Price List	Coal Capacity Cu. Ft.	Minimum Chimney Height Feet	Minimum Chimney Dimensions Inches	Outlets and Inlets
G276	1350	$505.00	7.93	40	12x12	2–4″
G277	1650	595.00	9.65	40	12x12	2–4″
G278	1950	685.00	11.37	45	12x12	3–4″
G279	2250	775.00	13.09	45	12x12	3–4″

Inclusive of trimmings—HEIGHT, 72 inches; WIDTH, 50¾ inches.
Height of Water Line, 45½ inches.

Water

G276	2230	$495.00	7.93	40	12x12	2–4″
G277	2720	585.00	9.65	40	12x12	2–4″
G278	3210	675.00	11.37	45	12x12	3–4″
G279	3700	765.00	13.09	45	12x12	3–4″

For smoke pipe, base dimensions and other measurements, see page 20.

Do not bush flow pipe outlets—connect them full size to the mains.

Use a larger boiler for soft coal.

For wood burning boilers, fire door 15¾″ x 11″, can be furnished on boilers shipped from factory.

Basis Used for Establishing Ratings

(Result of Laboratory Tests)

No.	Adequate Fuel (Anthracite) Lbs.	Recharging Reserve Lbs.	Fuel Consumed Lbs.	Evaporation per Lb. Fuel Lbs.	Total Steam Capacity Lbs.	*8-Hour Rating Square Feet
G276	389	78	311	8.7	2700	1350
G277	475	95	380	8.7	3300	1650
G278	561	112	449	8.7	3900	1950
G279	648	130	518	8.7	4500	2250

When fuel is consumed in shorter or longer period the hourly capacity is proportionately increased or decreased.

To establish 8-hour steam rating in square feet, divide the total steam capacity in pounds by eight and divide by 0.25.

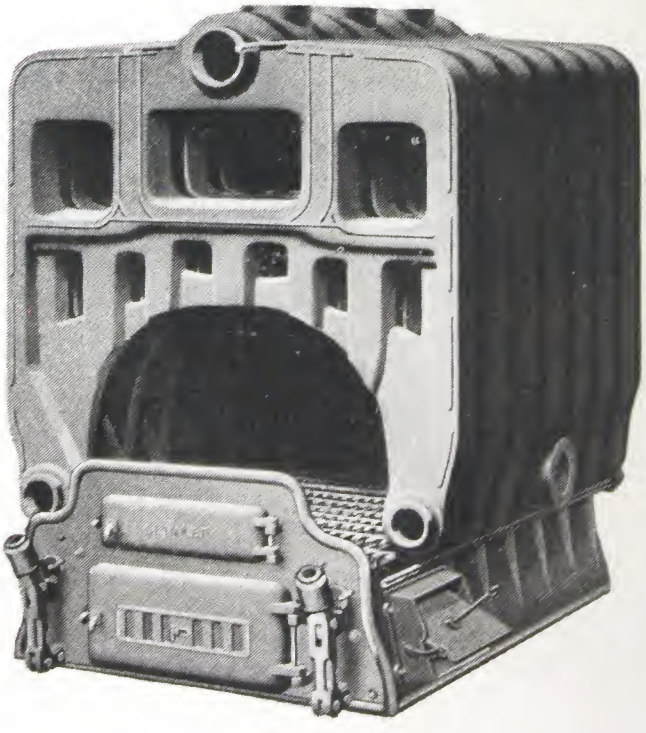
To determine hourly potential energy in B. T. U., divide total steam capacity by eight and multiply by 970.

Hourly potential energy in B. T. U., divided by 240 for steam and 150 for water, gives 8-hour rating.

***See Basis of Boiler Ratings, page 189.**

230 Series

238 Steam



238 Water

Steam

No.	*8-Hour Rating Square Feet	Price List	Coal Capacity Cu. Ft.	Minimum Chimney Height Feet	Minimum Chimney Dimensions Inches	Outlets and Inlets
235	1900	$ 670.00	11.01	40	12x16	2–4″
236	2350	797.00	13.75	45	12x16	2–4″
237	2800	905.00	16.49	45	16x16	3–4″
238	3250	995.00	19.22	50	16x16	3–4″
239	3700	1085.00	21.96	50	16x16	4–4″
240	4150	1175.00	24.70	60	16x16	4–4″

Inclusive of trimmings—HEIGHT, 74 inches; WIDTH, 60¼ inches.
Height of Water Line, 55 inches.

Water

235	3150	$655.00	11.01	40	12x16	2–4″
236	3900	782.00	13.75	45	12x16	2–4″
237	4650	890.00	16.49	45	16x16	3–4″
238	5450	980.00	19.22	50	16x16	3–4″
239	6150	1070.00	21.96	50	16x16	4–4″
240	6900	1160.00	24.70	60	16x16	4–4″

For smoke pipe, base dimensions and other measurements, see page 20.
Do not bush pipe flow outlets—connect them full size to the mains.
Use a larger boiler for soft coal.
For wood burning boilers, fire door 18″ x 12″ can be furnished on boilers shipped from factory.

Basis Used for Establishing Ratings

(Result of Laboratory Tests)

No.	Adequate Fuel (Anthracite) Lbs.	Recharging Reserve Lbs.	Fuel Consumed Lbs.	Evaporation per Lb. Fuel Lbs.	Total Steam Capacity Lbs.	*8-Hour Rating Square Feet
235	540	108	432	8.8	3800	1900
236	669	134	535	8.8	4700	2350
237	797	160	637	8.8	5600	2800
238	924	185	739	8.8	6500	3250
239	1052	211	841	8.8	7400	3700
240	1180	236	944	8.8	8300	4150

When fuel is consumed in shorter or longer period the hourly capacity is proportionately increased or decreased.

To establish 8-hour steam rating in square feet, divide the total steam capacity in pounds by eight and divide by 0.25.

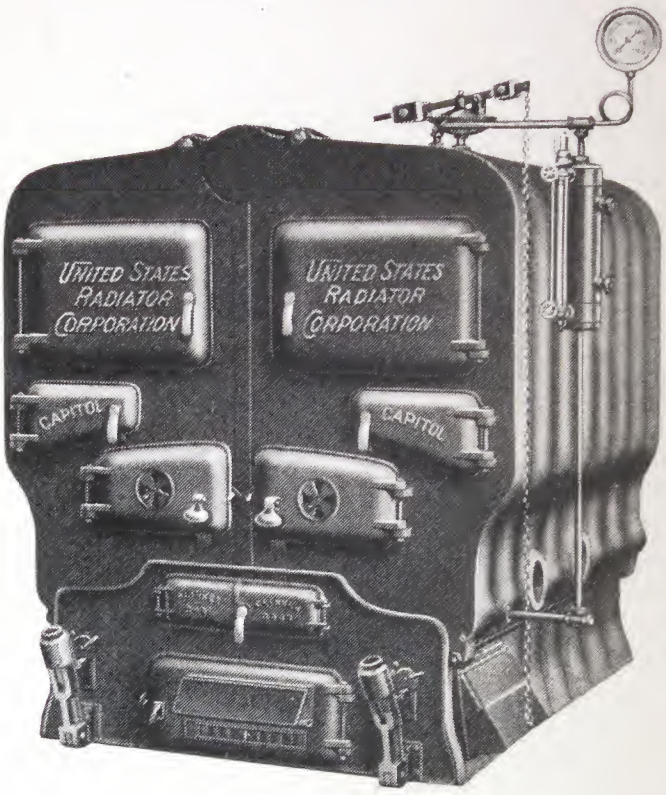
To determine hourly potential energy in B. T. U., divide total steam capacity by eight and multiply by 970.

Hourly potential energy in B. T. U., divided by 240 for steam and 150 for water, gives 8-hour rating.

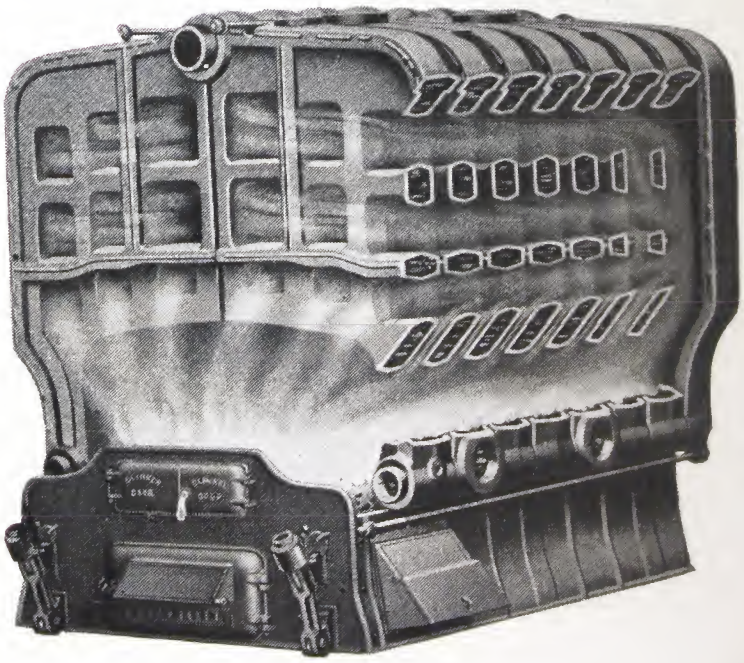
When thought necessary on account of draft conditions, the length of grate can be reduced by taking out one or more grate bars and filling in with fire brick.

***See Basis of Boiler Ratings, page 189.**

WN-270 Series



WN 278 Steam



WN 279 Water

Steam

No.	*Rating Square Feet	Price List	Coal Capacity Cu. Ft.	Minimum Chimney Height Feet	Minimum Chimney Dimensions Inches	Outlets and Inlets
WN 276	4550	$1250.00	24.66	50	20x24	3–5″
WN 277	5475	1435.00	29.67	55	24x24	3–5″
WN 278	6400	1620.00	34.68	60	24x24	3–5″
WN 279	7325	1805.00	39.69	60	24x24	4–5″
WN 280	8250	1990.00	44.71	65	24x28	4–5″
WN 281	9175	2175.00	45.96	70	28x28	4–5″
WN 282	10100	2360.00	47.21	70	28x28	4–5″
WN 283	11025	2545.00	48.46	75	28x32	5–5″
WN 284	11950	2730.00	49.72	80	32x32	5–5″

Inclusive of trimmings—HEIGHT, 92 inches; WIDTH, 82 inches.
Height of Water Line, 66 inches.
WN 282, 283 and 284 are furnished with bridge-wall plates to reduce length of ire box one or more sections. Can be furnished on other sizes when specified. See page 23.

Water

WN 276	7475	$1230.00	24.66	50	20x24	3–5″
WN 277	9000	1415.00	29.67	55	24x24	3–5″
WN 278	10525	1600.00	34.68	60	24x24	3–5″
WN 279	12050	1785.00	39.69	60	24x24	4–5″
WN 280	13575	1970.00	44.71	65	24x28	4–5″
WN 281	15100	2155.00	45.96	70	28x28	4–5″
WN 282	16625	2340.00	47.21	70	28x28	4–5″
WN 283	18100	2525.00	48.46	75	28x32	5–5″
WN 284	19600	2710.00	49.72	80	32x32	5–5″

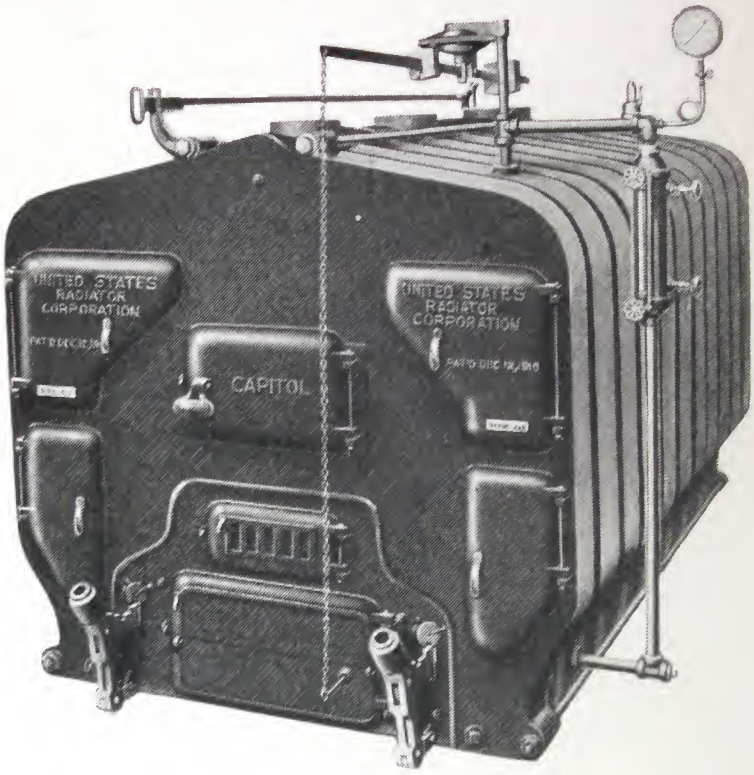
For smoke pipe, base dimensions and other measurements, see pages 20 and 22.
Do not bush flow pipe outlets—connect them full size to the mains.
WN 282, 283 and 284 are furnished with bridge-wall plates to reduce length of ire box one or more sections. Can be furnished on other sizes when specified. See page 23.

Basis Used for Establishing Ratings
(Result of Laboratory Tests)

No.	Fuel Consumed Per Hour, Lbs.	Evaporation Per Lb. Fuel Lbs.	Total Steam Capacity Lbs.	*Rating Sq. Ft.
WN 276	127	9	1138	4550
WN 277	153	9	1369	5475
WN 278	178	9	1600	6400
WN 279	204	9	1832	7325
WN 280	230	9	2063	8250
WN 281	255	9	2294	9175
WN 282	281	9	2525	10100
WN 283	306	9	2760	11025
WN 284	332	9	2985	11950

Laboratory Tests have demonstrated that available capacities on these boiler an be increased at least 25% by a corresponding increase in hourly coal consumption while maintaining average evaporative efficiency.
To establish rating in square feet, divide the total steam capacity in pounds y 0.25.
To determine hourly potential energy in B. T. U., multiply the total steam apacity by 970.
Hourly potential energy in B .T. U., divided by 240 for steam and 150 for water, ives rating in square feet.
***See Basis of Boiler Ratings, page 189.**

400 Series



No. 411 Smokeless (Steam)

Intermediate Section

Capitol Smokeless Boiler

Steam

No.	Rating Square Feet	List Price	Height Water Line Inches	Coal Capacity Cu. Ft.	Base Dimensions Inches	Outlets
408	3000	$ 945.00	49	9.00	63½x47	2–5″
409	3500	1045.00	49	10.40	71½x47	2–5″
410	4000	1145.00	49	13.30	79⅝x47	3–5″
411	4500	1240.00	49	14.70	87⅝x47	3–5″
412	5000	1340.00	49	16.30	95¾x47	3–5″
413	5500	1440.00	49	17.70	103¾x47	3–5″
414	6000	1540.00	49	19.25	111¾x47	4–5″

All 400 series boilers have two six-inch inlets on rear of back section.
Inclusive of trimmings—HEIGHT, 72 inches; WIDTH, 78 inches.

Water

408	4800	$ 930.00	..	9.00	63½x47	2–5″
409	5600	1030.00	..	10.40	71½x47	2–5″
410	6400	1130.00	..	13.30	79⅝x47	3–5″
411	7200	1220.00	..	14.70	87⅝x47	3–5″
412	8000	1320.00	..	16.30	95¾x47	3–5″
413	8800	1420.00	..	17.70	103¾x47	3–5″
414	9600	1520.00	..	19.25	111¾x47	4–5″

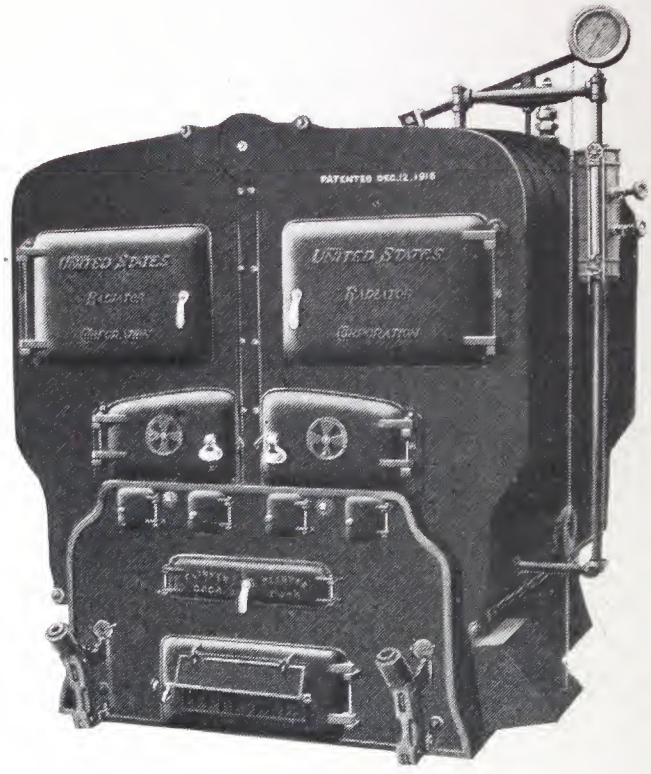
For smoke pipe and other measurements, see page 20.
Do not bush flow pipe outlets—connect them full size to the mains.

Capitol Smokeless Boiler

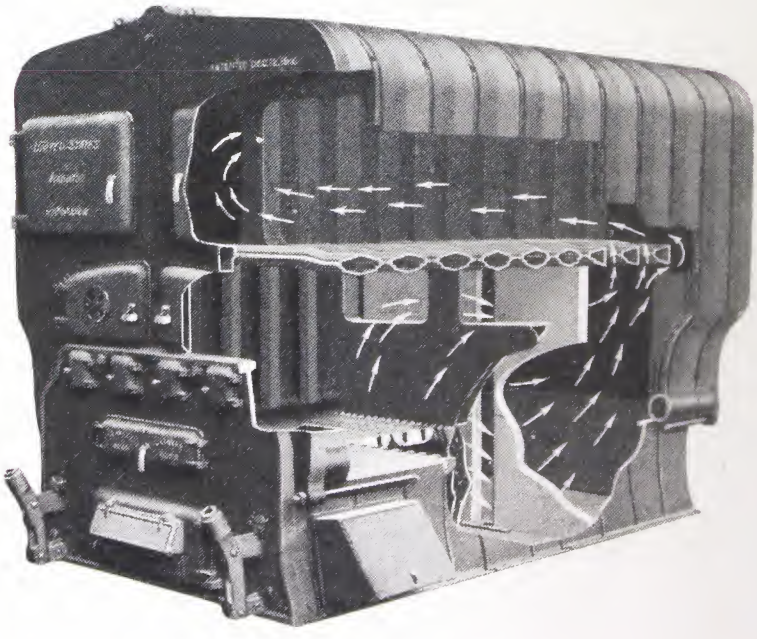
Chimney Sizes

No.	Minimum Height, Feet	Minimum Dimensions, Inches
408	50	18 x 18
409	50	18 x 18
410	55	20 x 20
411	55	20 x 20
412	55	22 x 22
413	60	24 x 24
414	60	24 x 24

500 Series



No 511 Smokeless (Steam



No. 511 Smokeless (Water)

Capitol Smokeless Boiler

Steam

No.	Rating Square Feet	Price List	Height Water Line Inches	Coal Capacity Cu. Ft.	Base Dimensions Inches	Outlets and Inlets
508	6275	$1648.00	66	18.87	57¾x 67⅞	3–5″
509	7150	1823.00	66	23.73	57¾x 77	4–5″
510	8025	1998.00	66	25.80	57¾x 86⅛	4–5″
511	8900	2173.00	66	28.59	57¾x 95¼	4–5″
512	9775	2348.00	66	29.58	57¾x104⅜	5–5″

Inclusive of trimmings—HEIGHT, 92 inches; WIDTH, 82 inches.

Water

508	10000	$1628.00	....	18.87	57¾x 67⅞	3–5″
509	11400	1803.00	....	23.73	57¾x 77	4–5″
510	13000	1978.00	....	25.80	57¾x 86⅛	4–5″
511	14250	2153.00	....	28.59	57¾x 95¼	4–5″
512	15650	2328.00	....	29.58	57¾x104⅜	5–5″

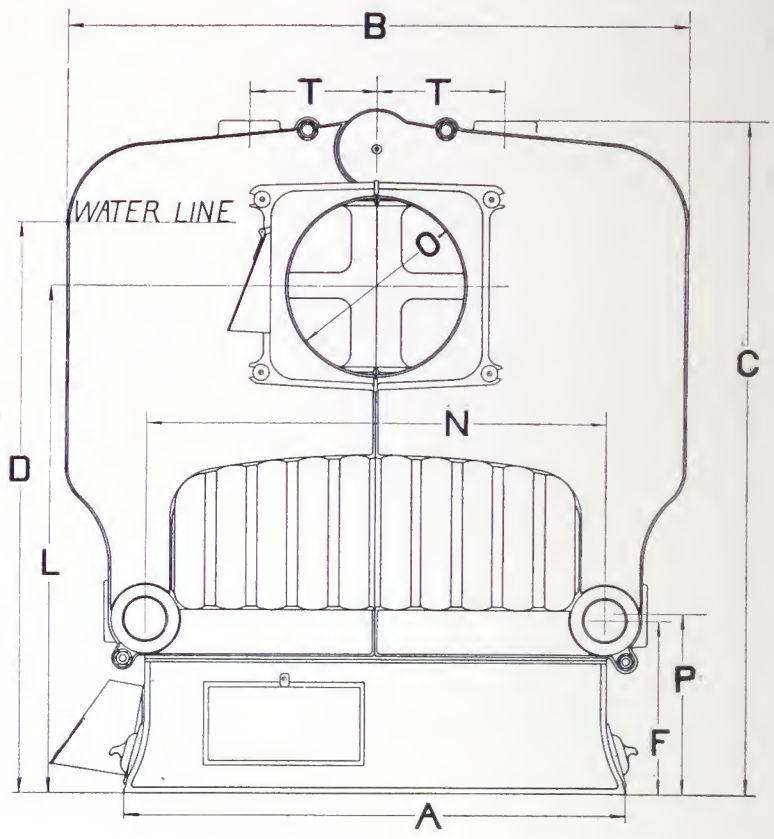
For smoke pipe and other measurements, see pages 20 and 22.
Do not bush flow pipe outlets—connect them full size to the mains.

Capitol Smokeless Boiler

Chimney Sizes

No.	Minimum Height, Feet	Minimum Dimensions, Inches
508	60	24 x 24
509	65	24 x 24
510	70	24 x 28
511	80	28 x 28
512	85	28 x 32

Measurements of 180, 200, 250, G-270, 230, WN-270 400 and 500 Series Boilers



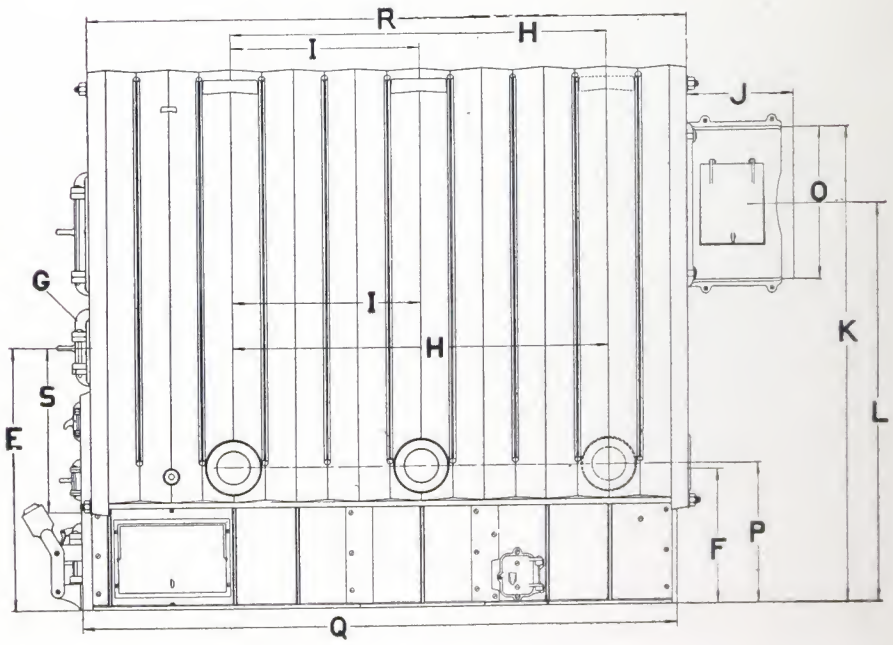


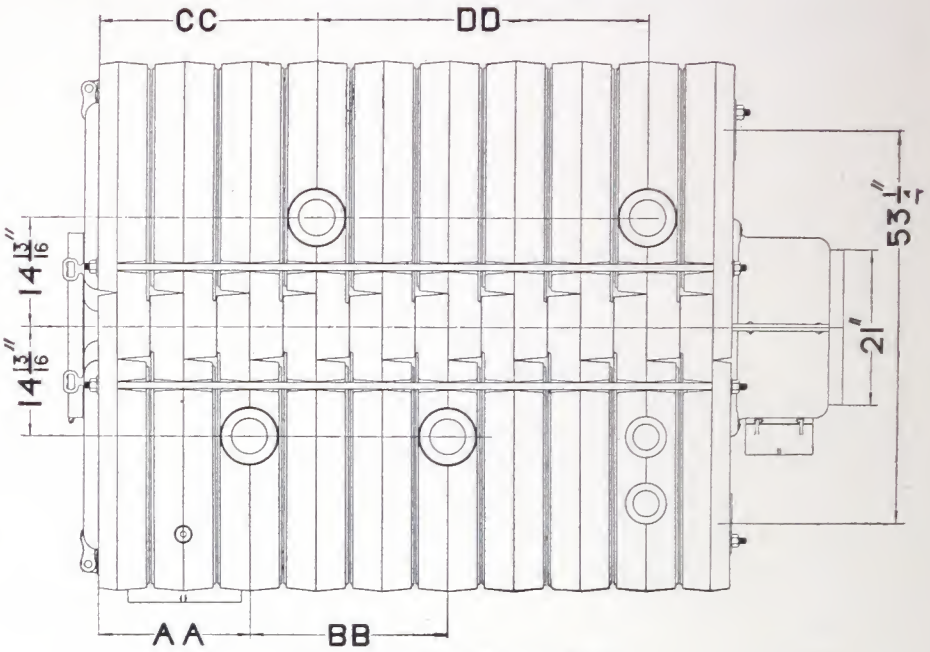
Table of Measurements of 180, 200, 250, G270, 230, WN270, 400, 500 Series Boilers

	180	200	250	G270	230	WN270	400	500
A	25½″	28¾″	34¼″	36 ″	41¼″	57¾″	47 ″	57¾″
B	28½″	32½″	39 1/16″	43½″	48½″	71¾″	67 ″	71¾″
C	48 ″	54 ″	58⅝″	55¾″	67 ″	77¾″	60¼″	77¾″
D	40½″	46½″	49 ″	45½″	55 ″	66 ″	49 ″	66 ″
E	25½″	29 11/16″	28 15/16″	27½″	31 ″	33¾″	35 ″	38 ″
F	....	....	....	....	....	20⅛″	7½″	20⅛″
G	7½″ x 11½″	9¾″ x 14½″	9¾″ x 14½″	8″ x 13″	9¾″ x 15¼″	10″ x 17″	10″ x 17″	10″ x 17″
**H	....	207—25 ″	257—32″ 258—40″	278—33¼″ 279—40½″	33″ on 237 and larger	See page 22	410—48½″ 413—64¾″ 411-12-14—56⅝″ 408-9-13-40½″	See page 22
I	184— 6¼″ 185—12½″ 186—18¾″ 187—25 ″	204— 6¼″ 205—12½″ 206—18¾″ 207—12½″	255—16″ 256—24″ 257—16″ 258—24″	276—20¼″ 277—27″ 278—13½″ 279—20¼″	16½″	See page 22	410—16⅛″ 411-14—24¼″ 412—32″	See page 22
J	12 ″	11½″	11½″	16 ″	14 ″	15 ″	19½″	15 ″
†K	44½″	50 11/16″	52 5/32″	50 ″	59 ″	72 ″	54¾″	72 ″
†L	37 ″	43 3/16″	45 5/32″	41½″	52 ″	58¾″	45½″	58¾″
§N	....	....	....	....	....	53¼″	46 ″	53¼″
O	10 ″	10 ″	12 ″	14 ″	14 ″	21 ″	18 ″	21 ″
P	14¼″	16¾″	17¼″	16 ″	19 ″	20⅞″	....	20⅞″
Q	184—20¼-in.: add 6¼-in. for each additional section.	204—23½-in.: add 6¼-in. for each additional section.	255—37¼-in.: add 8-in. for each additional section.	G276—36-in.: add 6¾-in. for each additional section.	235—36½-in.: add 8¼-in. for each additional section.	WN276—49⅝″: add 9⅛-in. for each additional section.	408—63½-in.: add 8⅛-in. for each additional section.	508—67⅞-in.: add 9⅛-in. for each additional section.
R	184—20¾-in.: add 6¼-in. for each additional section.	204—22¾-in.: add 6¼-in. for each additional section.	255—36½-in.: add 8-in. for each additional section.	G276—35¾-in.: add 6¾-in. for each additional section.	235—37½-in.: add 8¼-in. for each additional section.	WN276—50 7/16-in.: add 9⅛-in. for each additional section-section.	408—62⅝-in.: add 8⅛-in. for each additional section.	508—68⅝-in.: add 9⅛-in. for each additional section.
*S	14¼″	18 ″	17 ″	15½″	18 ″	19¼″	19 ″	23½″
‡T	....	....	....	....	....	14 13/16″	....	14 13/16″

*Center of fire door above grate level. **On 414, fourth tapping is 72¾″ from first tapping.
†Dimension K is for top outlet smoke hood which can be furnished on 180, 200, 250, G270, 230, WN270, 400 and 500 series.
‡Additional measurements, page 22.
§Back openings must be connected across back of boiler with a pipe not less than 3 inches in diameter on WN270 and 500.

Tapping Measurements

WN270 and 500 Series



Cut Showing Top of Boiler

Measurements WN270 Series

Sections	Right Side		Left Side		
	AA	BB	CC	DD	*EE
6	20 11/16"	.....	11 5/8"	27 5/16"	.....
7	20 11/16"	18 3/16"	48 "	.....	.....
8	20 11/16"	18 3/16"	57 1/16"	.....	.....
9	20 11/16"	27 5/16"	38 7/8"	27 5/16"	.....
10	20 11/16"	36 3/8"	38 7/8"	36 3/8"	.....
11	20 11/16"	45 1/2"	48 "	36 3/8"	.....
12	20 11/16"	45 1/2"	48 "	45 1/2"	.....
13	38 7/8"	36 3/8"	11 9/16"	45 1/2"	45 1/2"
14	38 7/8"	45 1/2"	11 9/16"	54 9/16"	45 1/2"

Measurements 500 Series

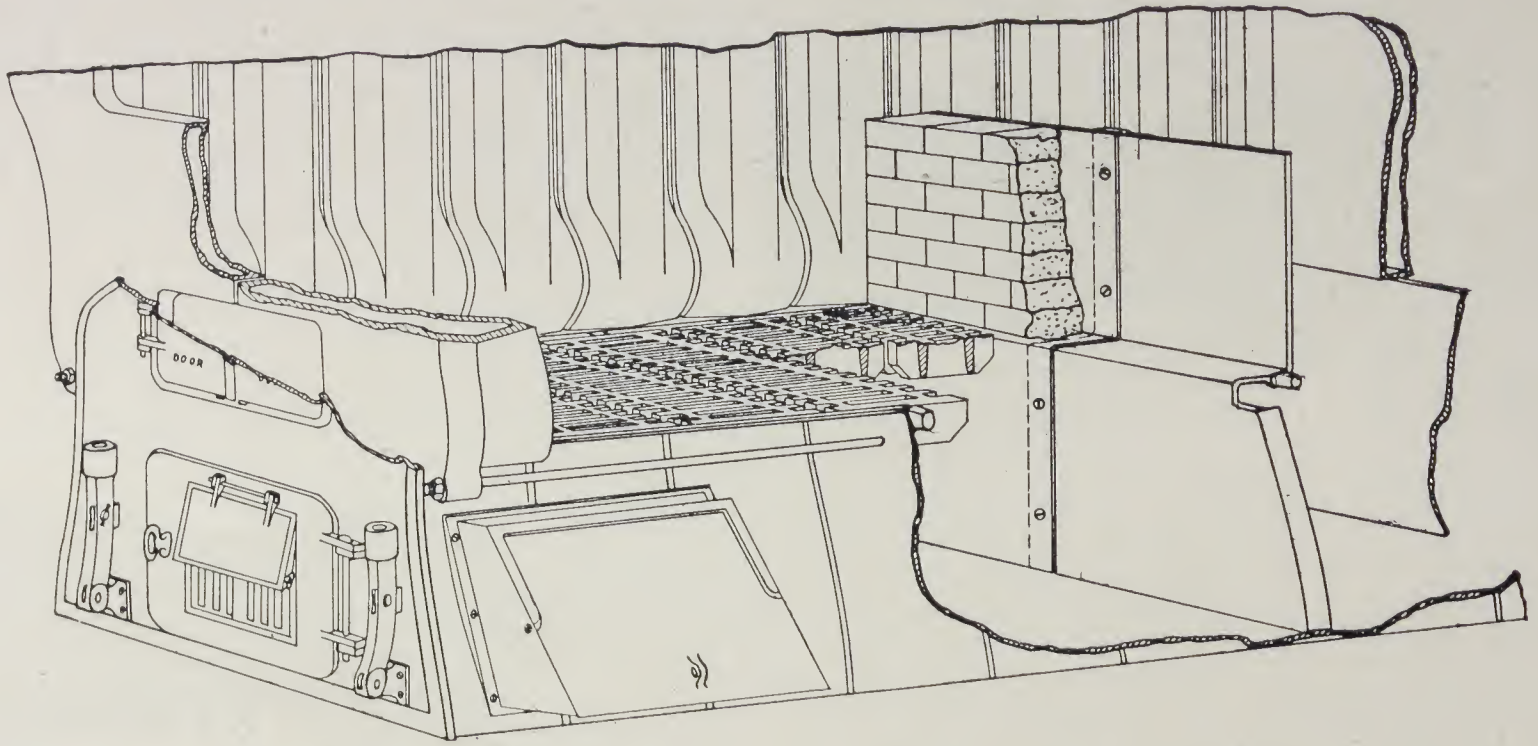
Sections	Right Side		Left Side		
	AA	BB	CC	DD	*EE
508	20 11/16"	.....	48 "	9 1/8"	.....
509	20 11/16"	.....	29 3/4"	27 5/16"	9 1/8"
510	20 11/16"	27 5/16"	29 3/4"	45 1/2"	.....
511	20 11/16"	27 5/16"	66 3/16"	18 3/16"	.....
512	20 11/16"	27 5/16"	29 3/4"	45 1/2"	18 3/16"

Flow and return tappings are on the same half sections.

*EE—Distance between second and third tappings on boilers having three tappings on left hand side.

The above measurements are subject to variations in assembling.

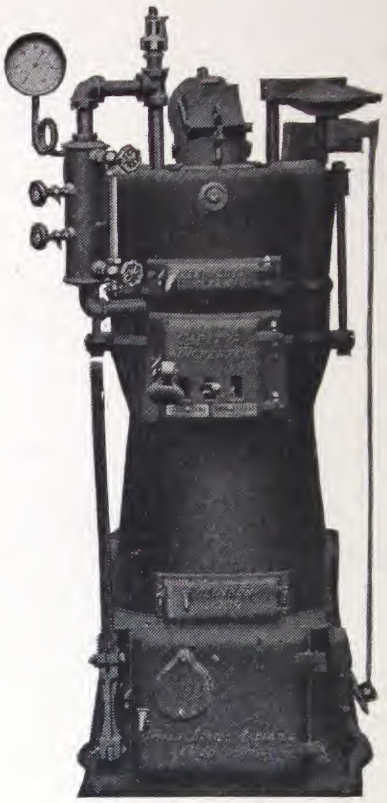
Bridge Wall Plates for WN270 Series



The Bridge Wall consists of two cast iron plates bolted together at center and held in place by trunnions which fit into grate sockets.

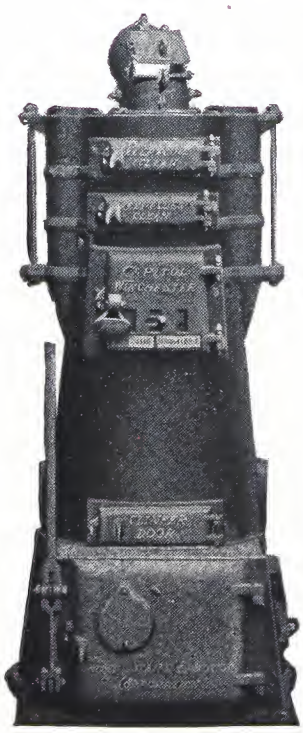
The upper half of plates are protected from the fuel bed by the use of fire brick.

3100 Series



No. 3130
Steam Boiler

4100 Series



No. 4140
Water Boiler

Capitol Winchester

Steam

No.	*8-Hour Rating Square Feet	List Price	Actual Grate Diam. Inches	Grate Area Square Feet	Height Water Line Inches	Height Outlets Inches	Minimum Chimney Height Feet	Minimum Chimney Dimensions Inches
130	200	$114.00	15	1.23	44½	49 3/16	30	8 x 8
140	225	123.00	15	1.23	48¾	53 9/16	35	8 x 8

Water

130	325	$ 96.50	15	1.23	....	43 15/16	30	8 x 8
140	375	105.50	15	1.23	....	47 15/16	35	8 x 8

Outlets and Inlets, 2–2½ inches; Smoke Pipe, 6 inches.

For other measurements, see page 38.

Basis Used for Establishing Ratings

(Result of Laboratory Tests)

No.	Adequate Fuel Anthracite, Lbs.	Recharging Reserve, Lbs.	Fuel Consumed, Lbs.	Evaporation per Lb. Fuel Lbs.	Total Steam Capacity Lbs.	*8-Hour Rating, Square Feet	Fuel Available 80% Fuel Capacity Lbs.
3130	63	13	50	8.00	400	200	60
3140	67	14	53	8.50	450	225	63

When fuel is consumed in shorter or longer period the hourly apacity is proportionately increased or decreased.

To establish 8-hour steam rating in square feet, divide the total team capacity in pounds by eight and divide by 0.25.

To determine hourly potential energy in B. T. U., divide total team capacity by eight and multiply by 970.

Hourly potential energy in B. T. U., divided by 240 for steam nd 150 for water, gives 8-hour rating.

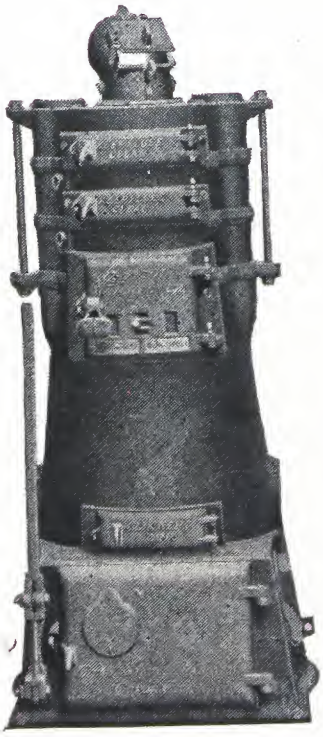
A larger size of fire-pot is recommended when soft coal is used.

*See Basis of Boiler Ratings, page 189.

3200 Series

No. 3230
Steam Boiler

4200 Series



No. 4240
Water Boiler

Capitol Winchester

Steam

No.	*8-Hour Rating Square Feet	List Price	Actual Grate Diam. Inches	Grate Area Square Feet	Height Water Line Inches	Height Outlets Inches	Minimum Chimney Height Feet	Minimum Chimney Dimensions Inches
230	250	$132.00	17	1.58	45	49½	30	8 x 8
240	300	149.50	17	1.58	50	54 1/16	35	8 x 8

Water

230	425	$123.00	17	1.58	....	44¼	30	8 x 8
240	500	140.50	17	1.58	....	48 13/16	35	8 x 8

Outlets and Inlets, 2–2½ inches; Smoke Pipe, 7 inches.

For other measurements, see page 38.

Basis Used for Establishing Ratings

(Result of Laboratory Tests)

No.	Adequate Fuel Anthracite, Lbs.	Recharging Reserve, Lbs.	Fuel Consumed, Lbs.	Evaporation per Lb. Fuel Lbs.	Total Steam Capacity Lbs.	*8-Hour Rating, Square Feet	Fuel Available 80% Fuel Capacity Lbs.
3230	74	15	59	8.50	500	250	73
3240	87	18	69	8.75	600	300	85

When fuel is consumed in shorter or longer period the hourly capacity is proportionately increased or decreased.

To establish 8-hour steam rating in square feet, divide the total steam capacity in pounds by eight and divide by 0.25.

To determine hourly potential energy in B. T. U., divide total steam capacity by eight and multiply by 970.

Hourly potential energy in B. T. U., divided by 240 for steam and 150 for water gives 8-hour rating.

A larger size of fire-pot is recommended when soft coal is used.

***See Basis of Boiler Ratings, page 189.**

3300 Series

No. 3330
Steam Boiler

4300 Series

No. 4340
Water Boiler

Capitol Winchester

Steam

No.	*8-Hour Rating Square Feet	List Price	Actual Grate Diam. Inches	Grate Area Square Feet	Height Water Line Inches	Height Outlets Inches	Minimum Chimney Height Feet	Minimum Chimney Dimensions Inches
330	325	$158.00	20	2.18	44¾	49 15/16	35	8 x 12
340	375	180.00	20	2.18	49¾	54¾	35	8 x 12
350	425	199.50	20	2.18	54¾	59 9/16	35	8 x 12

Water

430	550	$153.50	20	2.18	....	44 11/16	35	8 x 12
440	625	171.00	20	2.18	....	49½	35	8 x 12
450	700	191.00	20	2.18	....	54 5/16	35	8 x 12

Outlets and Inlets, 2–2½ inches; Smoke Pipe, 7 inches.

For other measurements, see page 38.

Basis Used for Establishing Ratings

(Result of Laboratory Tests)

No.	Adequate Fuel Anthracite, Lbs.	Recharging Reserve, Lbs.	Fuel Consumed, Lbs.	Evaporation per Lb. Fuel Lbs.	Total Steam Capacity Lbs.	*8-Hour Rating, Square Feet	Fuel Available 80% Fuel Capacity Lbs.
330	94	19	75	8.75	650	325	98
340	105	21	84	9.00	750	375	110
350	115	23	92	9.25	850	425	120

When fuel is consumed in shorter or longer period the hourly capacity is proportionately increased or decreased.

To establish 8-hour steam rating in square feet, divide the total steam capacity in pounds by eight and divide by 0.25.

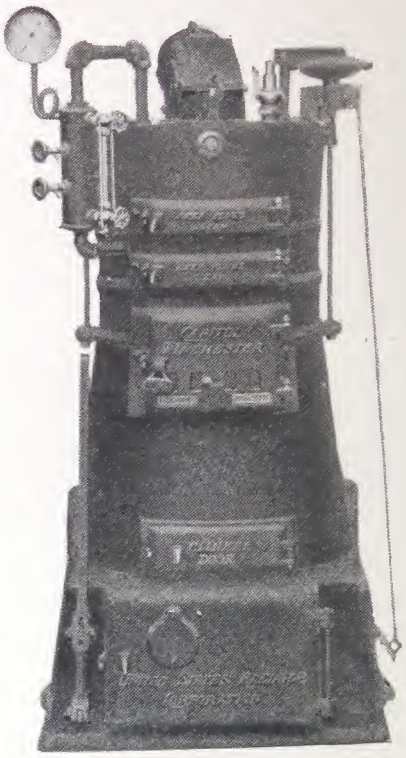
To determine hourly potential energy in B. T. U., divide total steam capacity by eight and multiply by 970.

Hourly potential energy in B. T. U., divided by 240 for steam and 150 for water, gives 8-hour rating.

A larger size of fire-pot is recommended when soft coal is used.

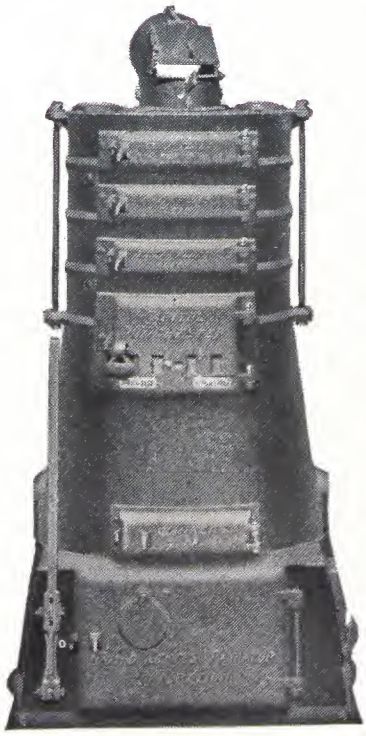
*See Basis of Boiler Ratings, page 189.

3400 Series



No. 3440
Steam Boiler

4400 Series



No. 4450
Water Boiler

Capitol Winchester

Steam

No.	*8-Hour Rating Square Feet	List Price	Actual Grate Diam. Inches	Grate Area Square Feet	Height Water Line Inches	Height Outlets Inches	Minimum Chimney Height Feet	Minimum Chimney Dimensions Inches
3440	500	$219.50	24½	3.27	51½	56⅛	35	8 x 12
3450	575	240.00	24½	3.27	56½	61	40	8 x 12
3460	650	287.50	24½	3.27	61½	65 13/16	40	8 x 12

Water

440	825	$210.50	24½	3.27	....	50⅞	35	8 x 12
450	950	230.00	24½	3.27	....	55¾	40	8 x 12
460	1075	277.50	24½	3.27	....	60 9/16	40	8 x 12

Outlets and Inlets, 2–3 inches; Smoke Pipe, 8 inches.

For other measurements, see page 38.

Basis Used for Establishing Ratings

(Result of Laboratory Tests)

No.	Adequate Fuel Anthracite, Lbs.	Recharging Reserve, Lbs.	Fuel Consumed, Lbs.	Evaporation per Lb. Fuel Lbs.	Total Steam Capacity Lbs.	*8-Hour Rating, Square Feet	Fuel Available 80% Fuel Capacity Lbs.
3440	143	29	114	8.80	1000	500	149
3450	159	32	127	9.10	1150	575	166
3460	174	35	139	9.40	1300	650	181

When fuel is consumed in shorter or longer period the hourly pacity is proportionately increased or decreased.

To establish 8-hour steam rating in square feet, divide the total eam capacity in pounds by eight and divide by 0.25.

To determine hourly potential energy in B. T. U., divide total eam capacity by eight and multiply by 970.

Hourly potential energy in B. T. U., divided by 240 for steam id 150 for water, gives 8-hour rating.

†Strong draft is necessary when these boilers are used for soft coal.

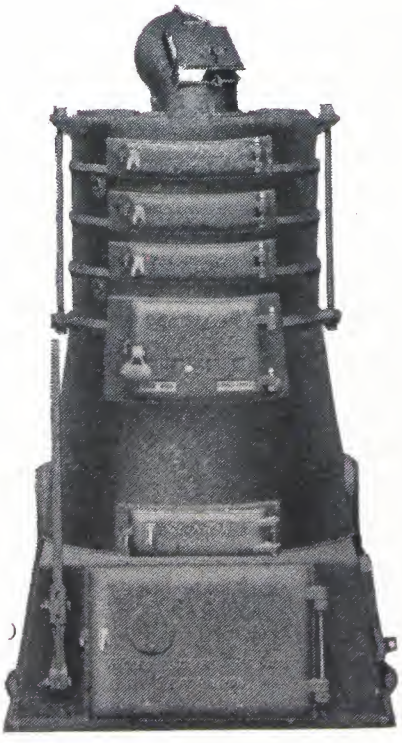
A larger size of fire-pot is recommended when soft coal is used.

***See Basis of Boiler Ratings, page 189.**

3500 Series

No. 3550
Steam Boiler

4500 Series



No. 4550
Water Boiler

Capitol Winchester

Steam

No.	*8-Hour Rating Square Feet	List Price	Actual Grate Diam. Inches	Grate Area Square Feet	Height Water Line Inches	Height Outlets Inches	Minimum Chimney Height Feet	Minimum Chimney Dimensions Inches
540	750	$317.00	29	4.59	53½	57 9/16	35	12 x 12
550	850	346.00	29	4.59	58⅝	62 7/16	40	12 x 12
560	950	375.00	29	4.59	63¾	67 5/16	45	12 x 12

Water

540	1225	$303.00	29	4.59	....	52 5/16	35	12 x 12
550	1400	336.00	29	4.59	....	57 3/16	40	12 x 12
560	1575	365.00	29	4.59	....	62 1/16	45	12 x 12

Outlets and Inlets, 2–4 inches; Smoke Pipe, 9 inches.
For other measurements, see page 38.

Basis Used for Establishing Ratings

(Result of Laboratory Tests)

No.	Adequate Fuel Anthracite, Lbs.	Recharging Reserve, Lbs.	Fuel Consumed, Lbs.	Evaporation per Lb. Fuel Lbs.	Total Steam Capacity Lbs.	*8-Hour Rating, Square Feet	Fuel Available 80% Fuel Capacity Lbs.
3540	215	43	172	8.75	1500	750	223
3550	237	48	189	9.00	1700	850	245
3560	258	52	206	9.25	1900	950	266

When fuel is consumed in shorter or longer period the hourly apacity is proportionately increased or decreased.

To establish 8-hour steam rating in square feet, divide the total eam capacity in pounds by eight and divide by 0.25.

To determine hourly potential energy in B. T. U., divide total eam capacity by eight and multiply by 970.

Hourly potential energy in B. T. U., divided by 240 for steam nd 150 for water, gives 8-hour rating.

†Strong draft is necessary when these boilers are used for soft coal.

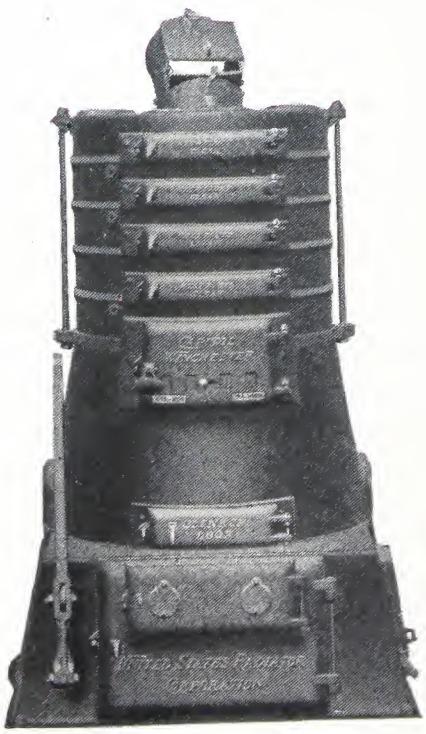
A larger size of fire-pot is recommended when soft coal is used.

***See Basis of Boiler Ratings, page 189.**

3600 Series

No. 3650
Steam Boiler

4600 Series



No. 4660
Water Boiler

Capitol Winchester

Steam

No.	*8-Hour Rating Square Feet	List Price	Actual Grate Diam. Inches	Grate Area Square Feet	Height Water Line Inches	Height Outlets Inches	Minimum Chimney Height Feet	Minimum Chimney Dimensions Inches
640	1100	$420.00	33	5.94	55	$59\frac{1}{16}$	40	12 x 12
650	1225	455.00	33	5.94	$60\frac{1}{8}$	$63\frac{15}{16}$	50	12 x 16
660	1350	492.00	33	5.94	$65\frac{1}{4}$	$68\frac{13}{16}$	60	12 x 16

Water

640	1825	$410.00	33	5.94	....	$53\frac{13}{16}$	40	12 x 12
650	2025	442.00	33	5.94	....	$58\frac{11}{16}$	50	12 x 16
660	2225	482.00	33	5.94	....	$63\frac{9}{16}$	60	12 x 16

Outlets and Inlets, 2–4 inches; Smoke Pipe, 10 inches.

For other measurements, see page 38. Equipped with rocking ate.

Basis Used for Establishing Ratings

(Result of Laboratory Tests)

No.	Adequate Fuel Anthracite, Lbs.	Recharging Reserve, Lbs.	Fuel Consumed, Lbs.	Evaporation per Lb. Fuel Lbs.	Total Steam Capacity Lbs.	*8-Hour Rating, Square Feet	Fuel Available 80% Fuel Capacity Lbs.
640	324	65	259	8.50	2200	1100	299
650	353	71	282	8.70	2450	1225	325
660	380	76	304	8.90	2700	1350	350

When fuel is consumed in shorter or longer period the hourly pacity is proportionately increased or decreased.

To establish 8-hour steam rating in square feet, divide the total eam capacity in pounds by eight and divide by 0.25.

To determine hourly potential energy in B. T. U., divide total eam capacity by eight and multiply by 970.

Hourly potential energy in B. T. U., divided by 240 for steam nd 150 for water, gives 8-hour rating.

†Strong draft is necessary when these boilers are used for soft coal.

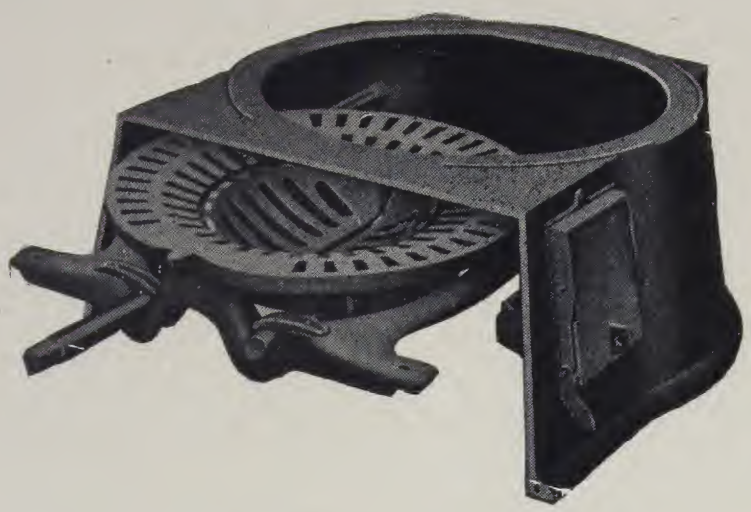
A larger size of fire-pot is recommended when soft coal is used.

***See Basis of Boiler Ratings, page 189.**

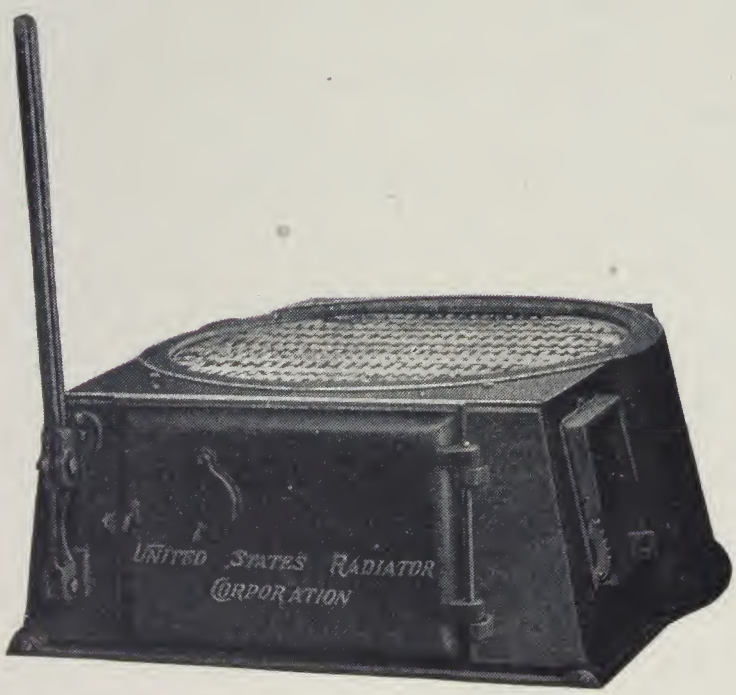
Capitol Winchester

Sectional View

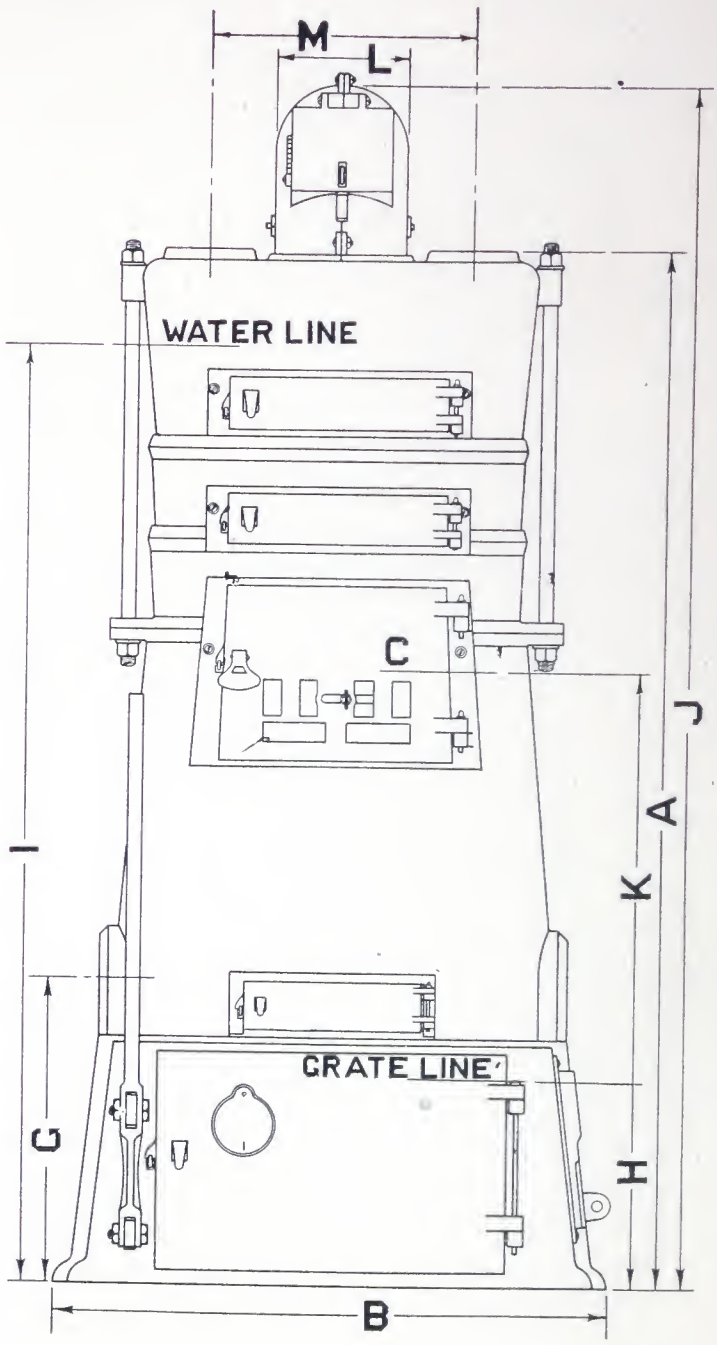
THE sections placed above the fire-pot are of two types, having different openings—one with the opening in the center, and the alternate one with openings at each side. This arrangement staggers the fire travel, which brings the heated gases in contact with every part of the sections.



Rotary Duplex Grate



Rocking Grate



Sectional View

(For Detailed Measurements, see opposite page

Steam trimmings extend 13 inches above outlets on 3100 and 3200 series, all others 10¾ inches.

Capitol-Winchester Boilers

MEASUREMENTS

Steam

Size	A	B	C	G	H	I	J	K	L	M
3130	49 3/16	24 1/4	8 x 8	16 1/8	8 7/8	44 1/2	56 3/8	23 1/2	6	13 11/16
3140	53 9/16	24 1/4	8 x 8	16 1/8	8 7/8	48 3/4	60 3/4	23 1/2	6	13 11/16
3230	49 1/2	26 1/4	8 x 9	16 1/8	8 7/8	45	56 11/16	23 1/2	7	13 11/16
3240	54 1/16	26 1/4	8 x 9	16 1/8	8 7/8	50	61 1/4	23 1/2	7	13 11/16
3330	49 15/16	29 5/16	9 x 11	16 1/8	8 7/8	44 3/4	58 1/8	23 1/2	7	13 11/16
3340	54 3/4	29 5/16	9 x 11	16 1/8	8 7/8	49 3/4	62 15/16	23 1/2	7	13 11/16
3350	59 9/16	29 5/16	9 x 11	16 1/8	8 7/8	54 3/4	67 3/4	23 1/2	7	13 11/16
3440	56 1/8	35	9 x 12	17 1/2	9 7/8	51 1/2	65 5/16	24 1/8	8	16 5/16
3450	61	35	9 x 12	17 1/2	9 7/8	56 1/2	70 3/16	24 1/8	8	16 5/16
3460	65 13/16	35	9 x 12	17 1/2	9 7/8	61 1/2	75	24 1/8	8	16 5/16
3540	57 9/16	40	9 x 13	19	10 9/16	53 1/2	67 11/16	24 11/16	9	17 13/16
3550	62 7/16	40	9 x 13	19	10 9/16	58 5/8	72 9/16	24 11/16	9	17 13/16
3560	67 5/16	40	9 x 13	19	10 9/16	63 3/4	77 7/16	24 11/16	9	17 13/16
3640	59 1/16	44 3/4	9 x 14	20 1/2	12 1/16	55	70 3/16	24 11/16	10	21 7/16
3650	63 15/16	44 3/4	9 x 14	20 1/2	12 1/16	60 1/8	75 1/16	24 11/16	10	21 7/16
3660	68 13/16	44 3/4	9 x 14	20 1/2	12 1/16	65 1/4	79 15/16	24 11/16	10	21 7/16

Capitol-Winchester Boilers

MEASUREMENTS

Water

Size	A	B	C	G	H	J	K	L	M
4130	43 15/16	24 1/4	8 x 8	16 1/8	8 7/8	51 1/8	23 1/2	6	13 11/16
4140	47 15/16	24 1/4	8 x 8	16 1/8	8 7/8	55 1/2	23 1/2	6	13 11/16
4230	44 1/4	26 1/4	8 x 9	16 1/8	8 7/8	51 7/16	23 1/2	7	13 11/16
4240	48 13/16	26 1/4	8 x 9	16 1/8	8 7/8	56	23 1/2	7	13 11/16
4330	44 11/16	29 5/16	9 x 11	16 1/8	8 7/8	52 7/8	23 1/2	7	13 11/16
4340	49 1/2	29 5/16	9 x 11	16 1/8	8 7/8	57 11/16	23 1/2	7	13 11/16
4350	54 5/16	29 5/16	9 x 11	16 1/8	8 7/8	62 1/2	23 1/2	7	13 11/16
4440	50 7/8	35	9 x 12	17 1/2	9 7/8	60 1/16	24 1/8	8	16 5/16
4450	55 3/4	35	9 x 12	17 1/2	9 7/8	64 15/16	24 1/8	8	16 5/16
4460	60 9/16	35	9 x 12	17 1/2	9 7/8	69 3/4	24 1/8	8	16 5/16
4540	52 5/16	40	9 x 13	19	10 9/16	62 7/16	24 11/16	9	17 13/16
4550	57 3/16	40	9 x 13	19	10 9/16	67 5/16	24 11/16	9	17 13/16
4560	62 1/16	40	9 x 13	19	10 9/16	72 3/16	24 11/16	9	17 13/16
4640	53 13/16	44 3/4	9 x 14	20 1/2	12 1/16	64 15/16	24 11/16	10	21 7/16
4650	58 11/16	44 3/4	9 x 14	20 1/2	12 1/16	69 13/16	24 11/16	10	21 7/16
4660	63 9/16	44 3/4	9 x 14	20 1/2	12 1/16	74 11/16	24 11/16	10	21 7/16

Trimmings

TRIMMINGS for steam boilers include low pressure steam gauge, water column, water gauge, gauge cocks, and metal automatic damper regulator. No trimmings are furnished with water boilers.

Regulator tapping ¾″.

Water column tappings 1″.

Safety valve tappings comply with the A. S. M. E. code as shown on page 196.

Grates

All boilers are provided with grates suitable for burning different grades of fuel. Grate bars with fine mesh can be furnished when ordered.

Tools

Firing tools will be furnished with all boilers listed herein.

Coil Openings

While we do not recommend the practice of installing coils or auxiliary heaters in the firebox of Capitol Boilers for heating water for domestic purposes, openings are provided in all hard coal boilers which may be used should the installation not justify the use of a separate hot water supply boiler.

Nipples

All boilers are assembled with cast iron push nipples manufactured in our own factories. These nipples are machine turned to the thousandth of an inch, and when assembled in the boiler, make a permanent iron to iron joint. No gaskets or packing are used in assembling Capitol Boilers.

Working Pressures

Boilers are built in accordance with the A. S. M. E. Standard, and are tested under water pressure of sixty pounds per square inch. The maximum working pressure should not exceed fifteen pounds per square inch on steam boilers or thirty pounds per square inch on water boilers, unless boiler has been specially tested at the factory at two and a half times the proposed working pressure.

Boilers specially tested for working pressures in excess of fifteen pounds on steam and thirty pounds on water should be equipped with high grade relief valve set to open at a reasonable, predetermined pressure. If requested, affidavit as to test pressure will be supplied but no responsibility against fracture is accepted by this company.

Asbestos Cement Required to Cover Boilers 1½ Inches Thick

Number	Pounds	Number	Pounds
184	200	WN276	750
185	225	WN277	850
186	250	WN278	950
187	275	WN279	1050
204	300	WN280	1150
205	325	WN281	1250
206	350	WN282	1350
207	375	WN283	1450
255	425	WN284	1550
256	475	408	525
257	525	409	575
258	575	410	650
G276	350	411	725
G277	400	412	775
G278	450	413	850
G279	500	414	900
235	550	508	950
236	610	509	1050
237	670	510	1150
238	730	511	1250
239	790	512	1350
240	850		

Amount of Asbestos Cement Required for Covering Capitol-Winchester Boilers 1½ Inches Thick

Steam Number	Water Number	Pounds	Steam Number	Water Number	Pounds
3130	4130	125	3440	4440	200
3140	4140	125	3450	4450	225
			3460	4460	225
			3540	4540	250
3230	4230	150	3550	4550	275
3240	4240	150	3560	4560	300
3330	4330	150	3640	4640	300
3340	4340	175	3650	4650	300
3350	4350	175	3660	4660	325

Sufficient cement for sealing the flues and for making the outside of the boiler smoke and fire tight is furnished with all Capitol Boilers. Additional cement for covering the boiler will be furnished at an extra charge, on special order.

Asbestos should be applied as follows: About twenty-four hours before using, mix with water to the consistency of thin mortar, enough asbestos for the first coat, which should be one-half of the entire thickness of the covering, and cover boiler, throwing on by handfuls with just enough force to make it stick without packing too solidly. The more loosely it is applied the more effective. When the first coat is thoroughly dry, apply the second coat in the same manner, having a thicker consistency. The third coat should be applied with a trowel and brought to a smooth finish. It is important for good results to allow each coat to thoroughly dry before applying the next. A canvas or heavy muslin jacket can now be pasted over the asbestos and made moisture-proof by painting with asphaltum. This will insure a permanent covering.

Asbestos is supplied in bags containing 25, 50 and 100 lbs. each.

Hot Water Supply Boilers

Boilers for hot water supply are manufactured in sizes to supply tanks of the following capacities:

2X	60 gallons
119	90 gallons
120	150 gallons
62	200 gallons
63	250 gallons

Hot Water Supply Ratings of Capitol Boilers

To determine the size of Capitol Boiler necessary to heat a storage tank for an eight hour firing period:

For Round Boilers

Multiply the number of U. S. gallons of water to be heated by the number of degrees the water is to be heated per hour to obtain the factor shown in table below, which will designate the proper size Capitol-Winchester Boiler to be used.

Boiler No.	Factor	Boiler No.	Factor	Boiler No.	Factor
4130	7470	4330	12180	4540	28380
4140	8040	4340	14040	4550	31920
4230	9095	4350	15660	4560	35580
4240	10840	4440	18960	4640	38150
		4450	21720	4650	42490
		4460	24120	4660	46750

Example

It is desired to raise the temperature of 350 gallons of water 25 degrees per hour.

350 x 25 = 8750 factor.

The nearest factor in table is 9095. Hence use boiler No. 4230.

Square Boilers

Multiply the number of U. S. gallons of water to be heated by the number of degrees the water is to be heated per hour and multiply the product by .00018. The result is the proper coal capacity in cu. ft. of a square water boiler.

Example

To raise the temperature 40 degrees of 800 gallons of water per hour:

800 x 40 x .00018 = 5.76 cu. ft. of coal capacity that is necessary.

Use boiler No. 205 of 5.85 cu. ft. of coal capacity.

Nipple Connections

ALL UNITED STATES Direct or Column RADIATORS are assembled with extra heavy malleable cast iron push nipples.

Threaded or screw nipple joints made up with rubber, asbestos, paper or composition washers are not used.

Push nipple connections do not need such washers or gaskets to make them tight—they are tapered iron-to-iron joints, permanently tight.

Push nipple connections are used in Capitol Boilers and United States Radiators.

Push nipple joints are easily taken apart and as easily put together again—a great advantage where long heavy radiators are handled on polished floors or elevated to upper stories.

Triton One-Column Radiators

For Steam and Water

Each section is 4½ inches wide. Width of legs, 5 1/32 inches.

MADE in the following special forms: Side Wall for Concealed Brackets, steam and water, page 72; Legs extra high, solid, for steam and water, page 73.

Direct-Indirect, for steam or water, page 64.

Corner, curved and circular, for steam and water, pages 68 and 69

Triton One-Column Radiators

List of Sizes

Number of Sections	*Length Inches	Heating Surface				
		38 Inch Height 3 Square Feet per Section	32 Inch Height 2½ Square Feet per Section	26 Inch Height 2 Square Feet per Section	22 Inch Height 1⅔ Square Feet per Section	20 Inch Height 1½ Square Feet per Section
2	5	6	5	4	3⅓	3
3	7½	9	7½	6	5	4½
4	10	12	10	8	6⅔	6
5	12½	15	12½	10	8⅓	7½
6	15	18	15	12	10	9
7	17½	21	17½	14	11⅔	10½
8	20	24	20	16	13⅓	12
9	22½	27	22½	18	15	13½
10	25	30	25	20	16⅔	15
11	27½	33	27½	22	18⅓	16½
12	30	36	30	24	20	18
13	32½	39	32½	26	21⅔	19½
14	35	42	35	28	23⅓	21
15	37½	45	37½	30	25	22½
16	40	48	40	32	26⅔	24
17	42½	51	42½	34	28⅓	25½
18	45	54	45	36	30	27
19	47½	57	47½	38	31⅔	28½
20	50	60	50	40	33⅓	30
21	52½	63	52½	42	35	31½
22	55	66	55	44	36⅔	33
23	57½	69	57½	46	38⅓	34½
24	60	72	60	48	40	36
25	62½	75	62½	50	41⅔	37½

Above radiators are tapped and bushed as per list on page 150.

Distance from floor to center of tapping, see page 151.

*Allow ½ inch for each bushing in estimating length of radiators.

See list prices, page 149.

Triton Two-Column Radiators

For Steam and Water

Each section is 7⅛ inches wide. Width of legs, 7 13/32 inches.

MADE in the following special forms: Side Wall for Concealed Brackets, steam and water, page 72; Legs extra high, solid (excepting 45-inch height), for steam and water, page 73; Direct-Indirect, for steam and water, page 64; and Hospital pattern, page 62.

Corner, curved and circular, for steam and water, pages 68 and 69.

Triton Two-Column Radiators

List of Sizes

No. of Sections	*Length Inches	Heating Surface						
		45 Inch Height 5 Square Feet per Section	38 Inch Height 4 Square Feet per Section	32 Inch Height 3⅓ Square Feet per Section	26 Inch Height 2⅔ Square Feet per Section	22 Inch Height 2¼ Square Feet per Section	20 Inch Height 2 Square Feet per Section	15 Inch Height 1½ Square Feet per Section
2	5	10	8	6⅔	5⅓	4½	4	3
3	7½	15	12	10	8	6¾	6	4½
4	10	20	16	13⅓	10⅔	9	8	6
5	12½	25	20	16⅔	13⅓	11¼	10	7½
6	15	30	24	20	16	13½	12	9
7	17½	35	28	23⅓	18⅔	15¾	14	10½
8	20	40	32	26⅔	21⅓	18	16	12
9	22½	45	36	30	24	20¼	18	13½
10	25	50	40	33⅓	26⅔	22½	20	15
11	27½	55	44	36⅔	29⅓	24¾	22	16½
12	30	60	48	40	32	27	24	18
13	32½	65	52	43⅓	34⅔	29¼	26	19½
14	35	70	56	46⅔	37⅓	31½	28	21
15	37½	75	60	50	40	33¾	30	22½
16	40	80	64	53⅓	42⅔	36	32	24
17	42½	85	68	56⅔	45⅓	38¼	34	25½
18	45	90	72	60	48	40½	36	27
19	47½	95	76	63⅓	50⅔	42¾	38	28½
20	50	100	80	66⅔	53⅓	45	40	30
21	52½	105	84	70	56	47¼	42	31½
22	55	110	88	73⅓	58⅔	49½	44	33
23	57½	115	92	76⅔	61⅓	51¾	46	34½
24	60	120	96	80	64	54	48	36
25	62½	125	100	83⅓	66⅔	56¼	50	37½

Above radiators tapped and bushed, as per list on page 150.

Distance from floor to center of tapping, see page 151.

*Allow ½ inch for each bushing in estimating length of radiators.

See list prices, page 149.

Triton Three-Column Radiators

For Steam and Water

Each section is 9 inches wide. Width of legs, $9\frac{5}{16}$ inches.

MADE in the following special forms: Side Wall for Concealed Brackets, steam and water, page 72; Legs extra high, solid (excepting 45-inch height), for steam and water, page 73; Direct-Indirect, for steam and water, page 64; Corner, curved and circular, for steam and water, pages 68 and 69.

Triton Three-Column Radiators

List of Sizes

No. of Sections	*Length Inches	Heating Surface					
		45 Inch Height 6 Square Feet per Section	38 Inch Height 5 Square Feet per Section	32 Inch Height 4½ Square Feet per Section	26 Inch Height 3¾ Square Feet per Section	22 Inch Height 3 Square Feet per Section	18 Inch Height 2¼ Square Feet per Section
2	5	12	10	9	7½	6	4½
3	7½	18	15	13½	11¼	9	6¾
4	10	24	20	18	15	12	9
5	12½	30	25	22½	18¾	15	11¼
6	15	36	30	27	22½	18	13½
7	17½	42	35	31½	26¼	21	15¾
8	20	48	40	36	30	24	18
9	22½	54	45	40½	33¾	27	20¼
10	25	60	50	45	37½	30	22½
11	27½	66	55	49½	41¼	33	24¾
12	30	72	60	54	45	36	27
13	32½	78	65	58½	48¾	39	29¼
14	35	84	70	63	52½	42	31½
15	37½	90	75	67½	56¼	45	33¾
16	40	96	80	72	60	48	36
17	42½	102	85	76½	63¾	51	38¼
18	45	108	90	81	67½	54	40½
19	47½	114	95	85½	71¼	57	42¾
20	50	120	100	90	75	60	45
21	52½	126	105	94½	78¾	63	47¼
22	55	132	110	99	82½	66	49½
23	57½	138	115	103½	86¼	69	51¾
24	60	144	120	108	90	72	54
25	62½	150	125	112½	93¾	75	56¼

Above radiators tapped and bushed, as per list on page 150.

Distance from floor to center of tapping, see page 151.

*Allow ½ inch for each bushing in estimating length of radiators.

See list prices, page 149.

Triton Four-Column Radiators

For Steam or Water

Each section is 12½ inches wide. Width of legs, 12 13/16 inches.

MADE in the following special forms: Side Wall for Concealed Brackets, steam or water, page 72; Legs extra high, solid (excepting 44-inch height), for steam or water, page 73; Direct-Indirect, for steam or water, page 64.

Triton Four-Column Radiators

List of Sizes

No. of Sections	*Length Inches	Heating Surface					
		44 Inch Height 10 Square Feet per Section	38 Inch Height 8 Square Feet per Section	32 Inch Height 6½ Square Feet per Section	26 Inch Height 5 Square Feet per Section	22 Inch Height 4 Square Feet per Section	18 Inch Height 3 Square Feet per Section
2	6	20	16	13	10	8	6
3	9	30	24	19½	15	12	9
4	12	40	32	26	20	16	12
5	15	50	40	32½	25	20	15
6	18	60	48	39	30	24	18
7	21	70	56	45½	35	28	21
8	24	80	64	52	40	32	24
9	27	90	72	58½	45	36	27
10	30	100	80	65	50	40	30
11	33	110	88	71½	55	44	33
12	36	120	96	78	60	48	36
13	39	130	104	84½	65	52	39
14	42	140	112	91	70	56	42
15	45	150	120	97½	75	60	45
16	48	160	128	104	80	64	48
17	51	170	136	110½	85	68	51
18	54	180	144	117	90	72	54
19	57	190	152	123½	95	76	57
20	60	200	160	130	100	80	60
21	63	210	168	136½	105	84	63
22	66	220	176	143	110	88	66
23	69	230	184	149½	115	92	69
24	72	240	192	156	120	96	72
25	75	250	200	162½	125	100	75

Above radiators are tapped and bushed, as per list on page 150.

Distance from floor to center of tapping, see page 151.

*Allow ½ inch for each bushing in estimating length of radiators.

See list prices, page 149.

Triton Five-Column Window Radiators

For Steam or Water

Each section is 13 inches wide. Width of legs, 13 inches.

MADE in the following special forms: Legs extra high, solid, fo steam or water, page 73; corner and curved, for steam or water, page 68.

Triton Five-Column Window Radiators

List of Sizes

Number of Sections	*Length Inches	Heating Surface		
		20 Inch Height 5½ Square Feet per Section	17 Inch Height 4¾ Square Feet per Section	14 Inch Height 4 Square Feet per Section
2	6	11	9½	8
3	9	16½	14¼	12
4	12	22	19	16
5	15	27½	23¾	20
6	18	33	28½	24
7	21	38½	33¼	28
8	24	44	38	32
9	27	49½	42¾	36
10	30	55	47½	40
11	33	60½	52¼	44
12	36	66	57	48
13	39	71½	61¾	52
14	42	77	66½	56
15	45	82½	71¼	60
16	48	88	76	64
17	51	93½	80¾	68
18	54	99	85½	72
19	57	104½	90¼	76
20	60	110	95	80
21	63	115½	99¾	84
22	66	121	104½	88
23	69	126½	109¼	92
24	72	132	114	96
25	75	137½	118¾	100

Above radiators are tapped and bushed, as per list on page 150.

Distance from floor to center of tapping, see page 151.

*Allow ½ inch for each bushing in estimating length of radiators.

See list prices, page 149.

Florentine One-Column Radiators

For Steam and Water

Each section is 4½ inches wide. Width of legs, 5 1/32 inches.

MADE in the following special forms: Side Wall for Concealed Brackets, steam and water, page 72. Legs extra high, solid, for steam and water, page 73.

Direct-Indirect, for steam or water, page 64.

Florentine One-Column Radiators

List of Sizes

Number of Sections	*Length Inches	Heating Surface				
		38 Inch Height 3 Square Feet per Section	32 Inch Height 2½ Square Feet per Section	26 Inch Height 2 Square Feet per Section	22 Inch Height 1⅔ Square Feet per Section	20 Inch Height 1½ Square Feet per Section
2	5	6	5	4	3⅓	3
3	7½	9	7½	6	5	4½
4	10	12	10	8	6⅔	6
5	12½	15	12½	10	8⅓	7½
6	15	18	15	12	10	9
7	17½	21	17½	14	11⅔	10½
8	20	24	20	16	13⅓	12
9	22½	27	22½	18	15	13½
10	25	30	25	20	16⅔	15
11	27½	33	27½	22	18⅓	16½
12	30	36	30	24	20	18
13	32½	39	32½	26	21⅔	19½
14	35	42	35	28	23⅓	21
15	37½	45	37½	30	25	22½
16	40	48	40	32	26⅔	24
17	42½	51	42½	34	28⅓	25½
18	45	54	45	36	30	27
19	47½	57	47½	38	31⅔	28½
20	50	60	50	40	33⅓	30
21	52½	63	52½	42	35	31½
22	55	66	55	44	36⅔	33
23	57½	69	57½	46	38⅓	34½
24	60	72	60	48	40	36
25	62½	75	62½	50	41⅔	37½

Above radiators are tapped and bushed, as per list on page 150.

Distance from floor to center of tapping, see page 151.

*Allow ½ inch for each bushing in estimating length of radiators.

See list prices, page 149.

Florentine Two-Column Radiators

For Steam and Water

Each section is 7⅛ inches wide. Width of legs, 7 13/32 inches.

MADE in the following special forms: Side Wall for Concealed Brackets, steam and water, page 72; Legs extra high, solid (excepting 45-inch height), for steam and water, page 73; Direct-Indirect, for steam and water, page 64.

Florentine Two-Column Radiators

List of Sizes

No. of Sections	*Length Inches	Heating Surface					
		45 Inch Height 5 Square Feet per Section	38 Inch Height 4 Square Feet per Section	32 Inch Height 3⅓ Square Feet per Section	26 Inch Height 2⅔ Square Feet per Section	22 Inch Height 2¼ Square Feet per Section	20 Inch Height 2 Square Feet per Section
2	5	10	8	6⅔	5⅓	4½	4
3	7½	15	12	10	8	6¾	6
4	10	20	16	13⅓	10⅔	9	8
5	12½	25	20	16⅔	13⅓	11¼	10
6	15	30	24	20	16	13½	12
7	17½	35	28	23⅓	18⅔	15¾	14
8	20	40	32	26⅔	21⅓	18	16
9	22½	45	36	30	24	20¼	18
10	25	50	40	33⅓	26⅔	22½	20
11	27½	55	44	36⅔	29⅓	24¾	22
12	30	60	48	40	32	27	24
13	32½	65	52	43⅓	34⅔	29¼	26
14	35	70	56	46⅔	37⅓	31½	28
15	37½	75	60	50	40	33¾	30
16	40	80	64	53⅓	42⅔	36	32
17	42½	85	68	56⅔	45⅓	38¼	34
18	45	90	72	60	48	40½	36
19	47½	95	76	63⅓	50⅔	42¾	38
20	50	100	80	66⅔	53⅓	45	40
21	52½	105	84	70	56	47¼	42
22	55	110	88	73⅓	58⅔	49½	44
23	57½	115	92	76⅔	61⅓	51¾	46
24	60	120	96	80	64	54	48
25	62½	125	100	83⅓	66⅔	56¼	50

Above radiators are tapped and bushed, as per list on page 150.

Distance from floor to center of tapping, see page 151.

*Allow ½ inch for each bushing in estimating length of radiators.

See list prices, page 149.

Florentine Three-Column Radiators

For Steam and Water

Each section is 9 inches wide. Width of legs, $9\frac{5}{16}$ inches.

MADE in the following special forms: Side Wall for Concealed Brackets, steam and water, page 72; Legs extra high, solid (excepting 45-inch height), for steam and water, page 73; Direct-Indirect, for steam and water, page 64.

Florentine Three-Column Radiators

List of Sizes

No. of Sections	*Length Inches	Heating Surface					
		45 Inch Height 6 Square Feet per Section	38 Inch Height 5 Square Feet per Section	32 Inch Height 4½ Square Feet per Section	26 Inch Height 3¾ Square Feet per Section	22 Inch Height 3 Square Feet per Section	18 Inch Height 2¼ Square Feet per Section
2	5	12	10	9	7½	6	4½
3	7½	18	15	13½	11¼	9	6¾
4	10	24	20	18	15	12	9
5	12½	30	25	22½	18¾	15	11¼
6	15	36	30	27	22½	18	13½
7	17½	42	35	31½	26¼	21	15¾
8	20	48	40	36	30	24	18
9	22½	54	45	40½	33¾	27	20¼
10	25	60	50	45	37½	30	22½
11	27½	66	55	49½	41¼	33	24¾
12	30	72	60	54	45	36	27
13	32½	78	65	58½	48¾	39	29¼
14	35	84	70	63	52½	42	31½
15	37½	90	75	67½	56¼	45	33¾
16	40	96	80	72	60	48	36
17	42½	102	85	76½	63¾	51	38¼
18	45	108	90	81	67½	54	40½
19	47½	114	95	85½	71¼	57	42¾
20	50	120	100	90	75	60	45
21	52½	126	105	94½	78¾	63	47¼
22	55	132	110	99	82½	66	49½
23	57½	138	115	103½	86¼	69	51¾
24	60	144	120	108	90	72	54
25	62½	150	125	112½	93¾	75	56¼

Above radiators tapped and bushed, as per list on page 150.

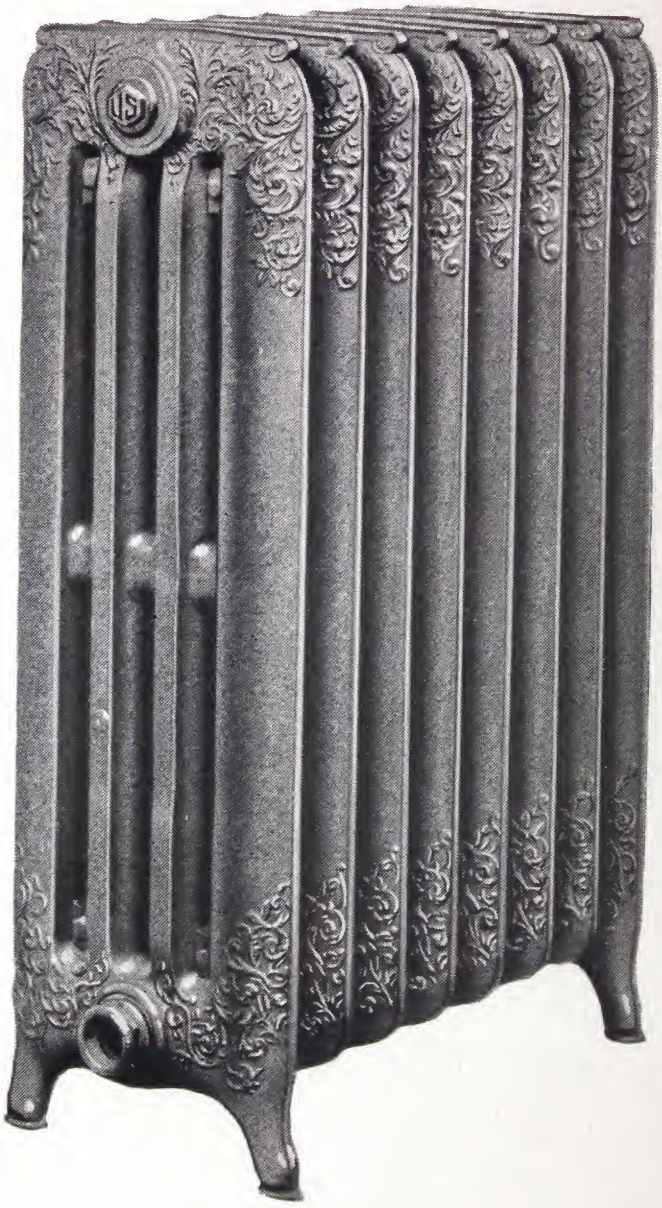
Distance from floor to center of tapping, see page 151.

*Allow ½ inch for each bushing in estimating length of radiators.

See list prices, page 149.

Florentine Four-Column Radiators

For Steam or Water



Each section is 12½ inches wide. Width of legs, 12 13/16 inches.

MADE in the following special forms: Side Wall for Concealed Brackets, steam or water, page 72; Legs extra high, solid (excepting 44-inch height), for steam or water, page 73; Direct-Indirect, for steam or water, page 64.

Florentine Four-Column Radiators

List of Sizes

No. of Sections	*Length Inches	Heating Surface					
		44 Inch Height 10 Square Feet per Section	38 Inch Height 8 Square Feet per Section	32 Inch Height 6½ Square Feet per Section	26 Inch Height 5 Square Feet per Section	22 Inch Height 4 Square Feet per Section	18 Inch Height 3 Square Feet per Section
2	6	20	16	13	10	8	6
3	9	30	24	19½	15	12	9
4	12	40	32	26	20	16	12
5	15	50	40	32½	25	20	15
6	18	60	48	39	30	24	18
7	21	70	56	45½	35	28	21
8	24	80	64	52	40	32	24
9	27	90	72	58½	45	36	27
10	30	100	80	65	50	40	30
11	33	110	88	71½	55	44	33
12	36	120	96	78	60	48	36
13	39	130	104	84½	65	52	39
14	42	140	112	91	70	56	42
15	45	150	120	97½	75	60	45
16	48	160	128	104	80	64	48
17	51	170	136	110½	85	68	51
18	54	180	144	117	90	72	54
19	57	190	152	123½	95	76	57
20	60	200	160	130	100	80	60
21	63	210	168	136½	105	84	63
22	66	220	176	143	110	88	66
23	69	230	184	149½	115	92	69
24	72	240	192	156	120	96	72
25	75	250	200	162½	125	100	75

Above radiators are tapped and bushed, as per list on page 150.

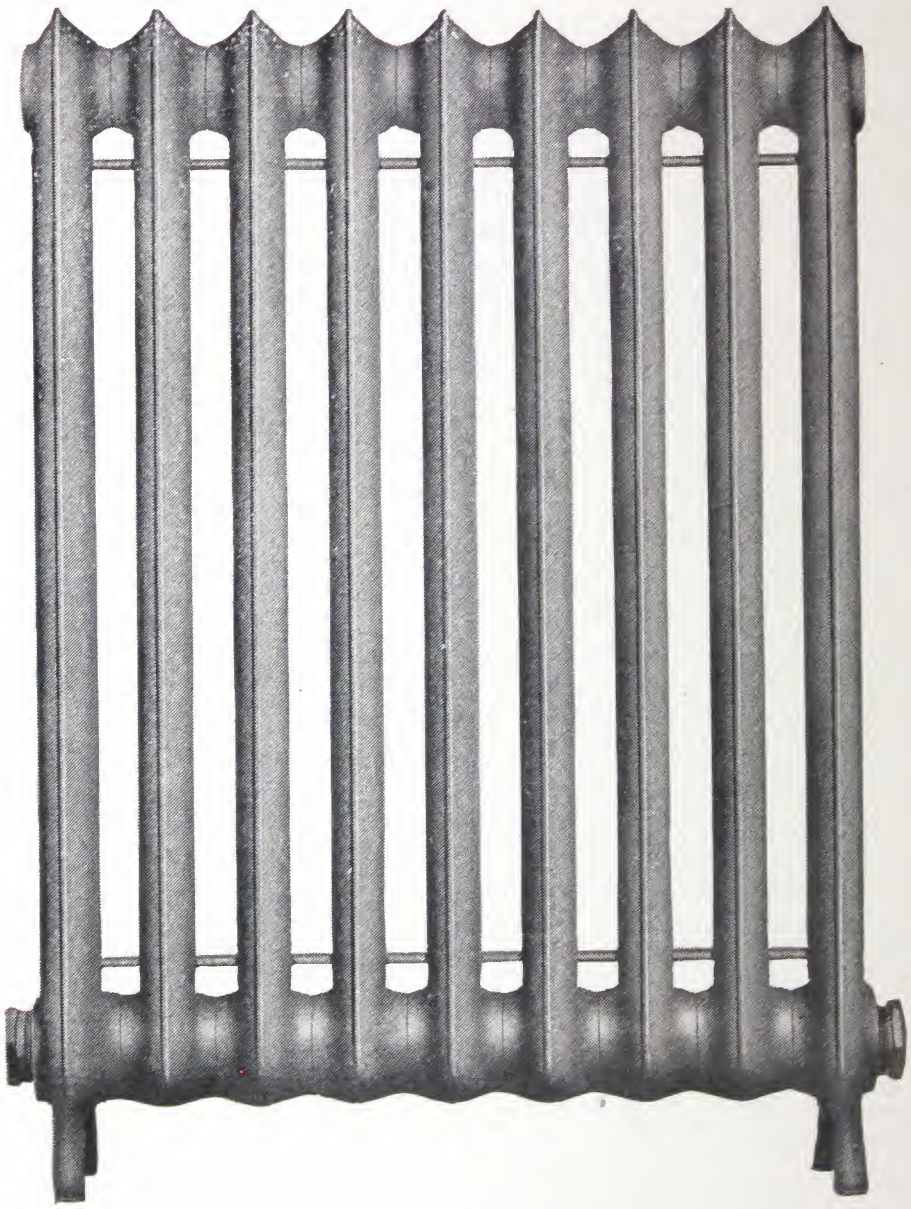
Distance from floor to center of tapping, see page 151.

*Allow ½ inch for each bushing in estimating length of radiators.

See list prices, page 149.

Triton Hospital Radiators

For Steam or Water



One column section 4½ inches wide.	Width of legs, 5 $\frac{1}{32}$ inches.
Two column section 7⅛ inches wide.	Width of legs, 7 $\frac{13}{32}$ inches.
Three column section 9 inches wide.	Width of legs, 9 $\frac{5}{16}$ inches.

Not made in special forms

RADIATORS specially designed for hospitals. The extra large spacings between sections allow easy cleaning. Triton Hospital Radiators are made in one, two and three column patterns, with three inch centers.

Triton Two-Column Hospital Radiators

List of Sizes

No. of Sections	*Length Inches	Heating Surface					
		45 Inch Height 5 Square Feet per Section	38 Inch Height 4 Square Feet per Section	32 Inch Height 3⅓ Square Feet per Section	26 Inch Height 2⅔ Square Feet per Section	22 Inch Height 2¼ Square Feet per Section	20 Inch Height 2 Square Feet per Section
2	6	10	8	6⅔	5⅓	4½	4
3	9	15	12	10	8	6¾	6
4	12	20	16	13⅓	10⅔	9	8
5	15	25	20	16⅔	13⅓	11¼	10
6	18	30	24	20	16	13½	12
7	21	35	28	23⅓	18⅔	15¾	14
8	24	40	32	26⅔	21⅓	18	16
9	27	45	36	30	24	20¼	18
10	30	50	40	33⅓	26⅔	22½	20
11	33	55	44	36⅔	29⅓	24¾	22
12	36	60	48	40	32	27	24
13	39	65	52	43⅓	34⅔	29¼	26
14	42	70	56	46⅔	37⅓	31½	28
15	45	75	60	50	40	33¾	30
16	48	80	64	53⅓	42⅔	36	32
17	51	85	68	56⅔	45⅓	38¼	34
18	54	90	72	60	48	40½	36
19	57	95	76	63⅓	50⅔	42¾	38
20	60	100	80	66⅔	53⅓	45	40
21	63	105	84	70	56	47¼	42
22	66	110	88	73⅓	58⅔	49½	44
23	69	115	92	76⅔	61⅓	51¾	46
24	72	120	96	80	64	54	48
25	75	125	100	83⅓	66⅔	56¼	50

Above radiators tapped and bushed, as per list on page 150.

Distance from floor to center of tapping, page 151.

*Allow ½ inch for each bushing in estimating length of radiator.

See list prices, page 149.

NOTE—Lengths of one and three column radiators are the same as for two column. Heating surfaces are the same as for regular Triton pattern.

Triton and Florentine Direct-Indirect Radiators

For Steam or Water

TRITON Box Bases made for One, Two, Three and Four Column Triton and Florentine Radiators. To change box base from back inlet to bottom inlet, set both dampers to operate together. Front and back aprons resting on top of base can readily be removed for cleaning.

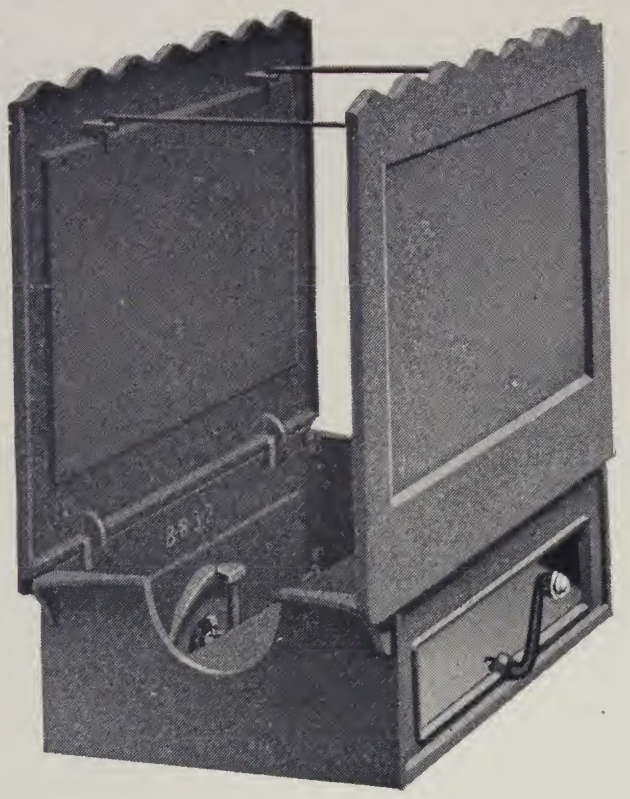
A 15 section Base is used on radiators of 15 sections or odd numbers above 15; and a 14 section Base is used on radiators of 14 sections or even numbers above 14.

When ordering Direct-Indirect Radiators specify sections under which the box base is to be installed, in order that center legs can be arranged accordingly.

See page 66 showing application of wall box and box base.

Direct-Indirect Box Base

For Triton and Florentine Radiators



Back Opening

No. of Section	1-Col.	2-Col.	3-Col.	4-Col.
5	2 5/16 x 5 3/16	2 11/16 x 5 3/16	2 11/16 x 5 3/16	3 3/16 x 6 9/16
6	2 5/16 x 7 11/16	2 11/16 x 7 11/16	2 11/16 x 7 11/16	3 3/16 x 9 5/8
7	2 5/16 x 10 3/16	2 11/16 x 10 3/16	2 11/16 x 10 3/16	3 3/16 x 12 5/8
8	2 5/16 x 12 11/16	2 11/16 x 12 11/16	2 11/16 x 12 11/16	3 3/16 x 15 5/8
9	2 5/16 x 15 3/16	2 11/16 x 15 5/16	2 11/16 x 15 5/16	3 3/16 x 18 13/16
10	2 5/16 x 17 11/16	2 11/16 x 17 13/16	2 11/16 x 17 13/16	3 3/16 x 21 13/16
11	2 5/16 x 20 3/16	2 11/16 x 20 5/16	2 11/16 x 20 5/16	3 3/16 x 24 13/16
12	2 5/16 x 22 11/16	2 11/16 x 22 11/16	2 11/16 x 22 11/16	3 3/16 x 27 3/4
13	2 5/16 x 25 3/16	2 11/16 x 25 3/16	2 11/16 x 25 3/16	3 3/16 x 30 11/16
14	2 5/16 x 27 11/16	2 11/16 x 27 11/16	2 11/16 x 27 11/16	3 3/16 x 33 11/16
15	2 5/16 x 30 3/16	2 11/16 x 30 3/16	2 11/16 x 30 3/16	3 3/16 x 36 11/16

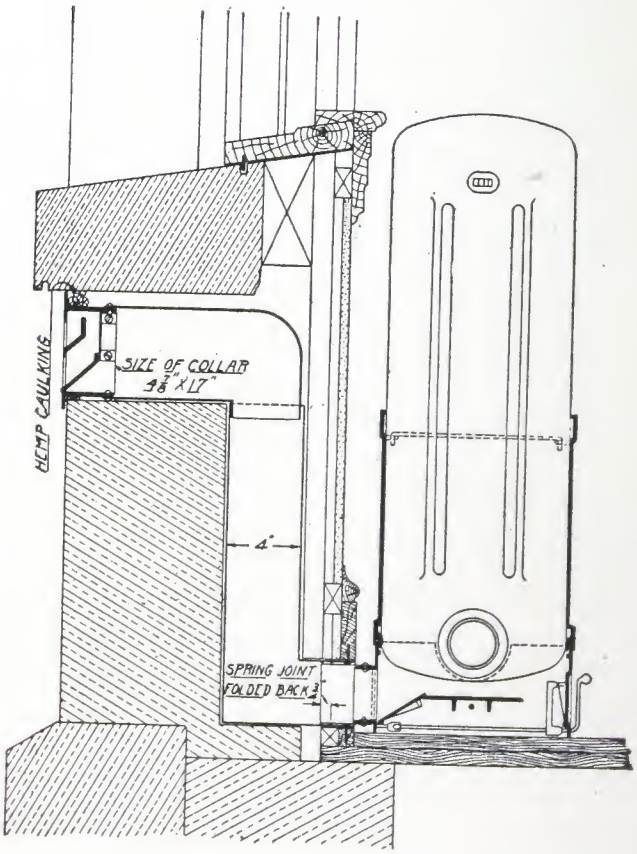
Maximum Bottom Opening

No. of Section	1-Col.	2-Col.	3-Col.	4-Col.
5	3½ x 5½	6⅛ x 5½	8 x 5½	11½ x 7
6	3½ x 8	6⅛ x 8	8 x 8	11½ x 10
7	3½ x 10½	6⅛ x 10½	8 x 10½	11½ x 13
8	3½ x 13	6⅛ x 13	8 x 13	11½ x 16
9	3½ x 15½	6⅛ x 15½	8 x 15½	11½ x 19
10	3½ x 18	6⅛ x 18	8 x 18	11½ x 22
11	3½ x 20½	6⅛ x 20½	8 x 20½	11½ x 25
12	3½ x 23	6⅛ x 23	8 x 23	11½ x 28
13	3½ x 25½	6⅛ x 25½	8 x 25½	11½ x 31
14	3½ x 28	6⅛ x 28	8 x 28	11½ x 34
15	3½ x 30½	6⅛ x 30½	8 x 30½	11½ x 37

Height of back air-inlet above floor ⅜ inches.

Wall Boxes

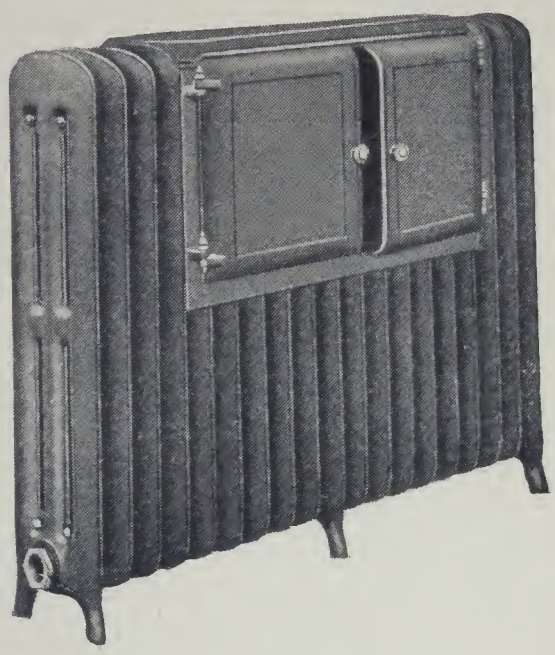
THE main part of box is constructed in one piece, which with angle slats in place, makes it water-tight and durable. A heavy copper screen is firmly held in position at back of box, making it insect-proof. From front flange to back of box, 2½ inches; size of opening in brickwork, 17¼ x 5⅛ inches; size of collar for galvanized iron, 17 x 4⅞ inches.



Sketch showing application of Wall Box and Box Base.

Dining-Room Radiators

For Steam and Water



Number	*Length in Inches	Heating Surface Square Feet	Price for Steam	Price for Water
1	32½	43	$ 92.00	$104.00
2	37½	53	100.00	114.00
3	42½	63	108.00	123.00
4	47½	73	116.00	132.00
5	52½	83	124.00	141.00
6	57½	93	132.00	150.00
7	62½	103	140.00	159.00
8	67½	113	148.00	168.00
9	72½	123	156.00	180.00
10	77½	133	164.00	190.00

Made in Triton Three-Column pattern only. See page 49. Ovens are all the same size, inside dimensions, 27 x 13¼ x 15½ inches. Height of radiator complete, 38¼ inches.

Distance from back of oven to center of radiator tappings, 7 inches.

*Allow ½ inch for each bushing in estimating length of radiator.

Corner Radiators

For Steam and Water

Made in regular heights of Triton and Florentine Radiators. See page 152.

Triton and Florentine Circular Radiators

Diameter in Inches

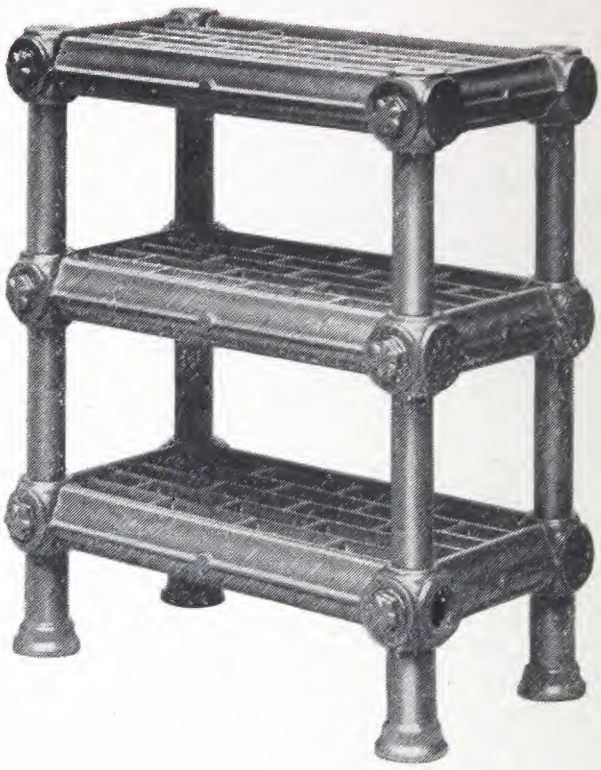
No. of Sections in Stack	1 Column		2 Column		3 Column	
	Inside Diam. at Legs	Outside Diam. at Legs	Inside Diam. at Legs	Outside Diam. at Legs	Inside Diam. at Legs	Outside Diam. at Legs
12	8 3/8	18 1/2	6	20 7/8	4 1/8	22 3/4
14	9 3/4	19 7/8	7 3/8	22 1/4	5 1/2	24 1/8
16	11 1/8	21 1/4	8 3/4	23 5/8	6 7/8	25 1/2
18	12 1/2	22 5/8	10 1/8	25	8 1/4	26 7/8
20	14 1/8	24 1/8	11 3/4	26 1/2	9 3/4	28 1/2
22	15 1/2	25 1/2	13 1/8	27 7/8	11 1/8	29 7/8
24	17 1/8	27 1/4	15	29 3/4	13	31 3/4
26	18 1/4	28 1/4	15 7/8	30 5/8	13 7/8	32 5/8
28	19 7/8	30	17 1/2	32 3/8	15 5/8	34 1/4
30	21	31 1/8	19 5/8	33 1/2	16 3/4	35 3/8
32	22 5/8	32 3/4	20 1/4	35 1/8	18 3/8	37
34	23 7/8	33 7/8	21 1/2	36 1/4	19 1/2	38 1/4
36	25 3/8	35 3/8	23	37 3/4	21	39 3/4
38	26 5/8	36 5/8	24 1/4	39	22 1/4	41
40	28	38 1/8	25 5/8	40 1/2	23 3/4	42 3/8
42	29 3/8	39 1/2	27	41 7/8	25 1/8	43 3/4
44	30 7/8	41	28 1/2	43 3/8	26 5/8	45 1/4
46	32 1/2	42 5/8	30 1/8	45	28 1/4	46 7/8
48	34 3/8	44 3/8	32	46 3/4	30	48 3/4
50	34 7/8	45	32 1/2	47 3/8	30 5/8	49 1/4
52	36 1/8	46 1/4	33 3/4	48 5/8	31 7/8	50 1/2
54	38	48 1/8	35 5/8	50 1/2	33 3/4	52 3/8
56	39	49 1/8	36 5/8	51 1/2	34 3/4	53 3/8
58	41	51	39 5/8	53 5/8	36 5/8	55 3/8
60	42 3/4	52 3/4	40 3/8	55 1/8	38 3/8	57 1/8

Circular Radiators may be ordered assembled in one piece or disconnected in halves to be assembled at the job. Or they may be built in halves to be installed as two separate radiators.

Marble Tops can be furnished if desired.

Pantry Radiator

For Steam or Water



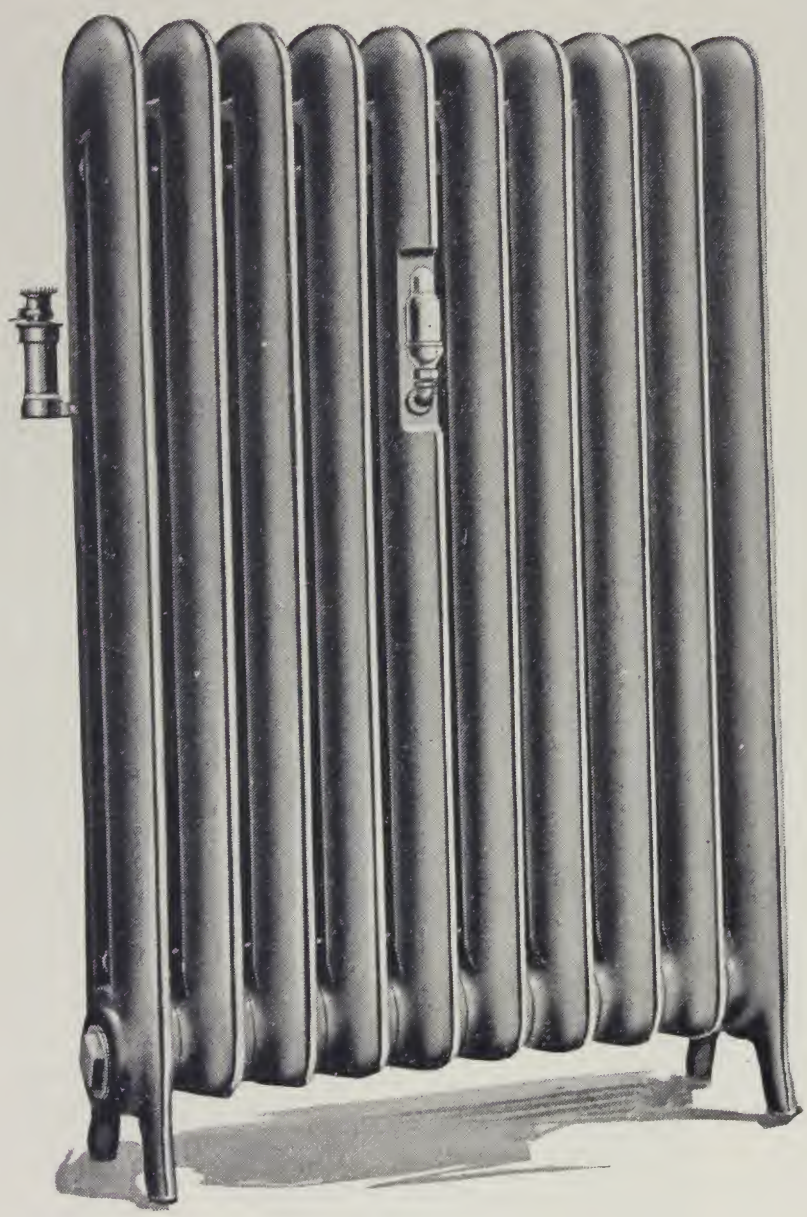
THIS radiator is useful for pantries, restaurants, dining rooms and any place where heat is required, and the additional service of plate warming needed. It is made up from seven-foot sections only. All openings on lower shelf are tapped.

The radiator may be constructed from one to five sections high as follows:

Number	Height Inches	Heating Surface Feet	List Price
1	7	7	$16.00
2	17	15	30.00
3	27	23	44.00
4	37	31	58.00
5	47	39	72.00

Length 24¼ inches. Width 13¼ inches.
Tapping, see page 150.

Triton Fractional Radiators



DESIGNED to meet the growing demand for regulation on one pipe steam installations.

The above arrangement of special recessed section and U. S. R. control air valve permits the operation of all or part of radiator as the occasion demands.

Furnished in various sizes, requires no special roughing in and shipped complete with vents.

Booklet explaining complete operation mailed on request.

Column Wall Radiators

With Concealed Brackets

For Steam or Water

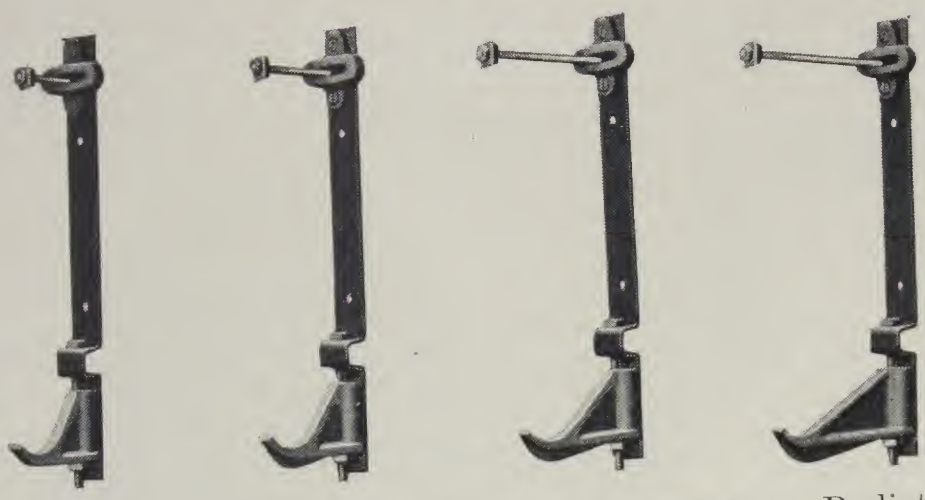
ABOVE illustration is representative of the Side Wall pattern of Florentine and Triton One, Two, Three and Four-Column Radiators.

List of sizes, heights, tappings, etc., same as the several styles referred to above.

For brackets, see page 73.

Adjustable Concealed Radiator Brackets

For Triton and Florentine Radiators



Made to support One, Two, Three and Four-Column Radiators.

Measurements

Wall to Center of Tappings

1 col. 4¼″
2 col. 5½″
3 col. 6½″
4 col. 8¼″

Pedestals

Solid cast-iron pedestals can be furnished for placing under legs of all styles of our radiators and are made in the following heights:

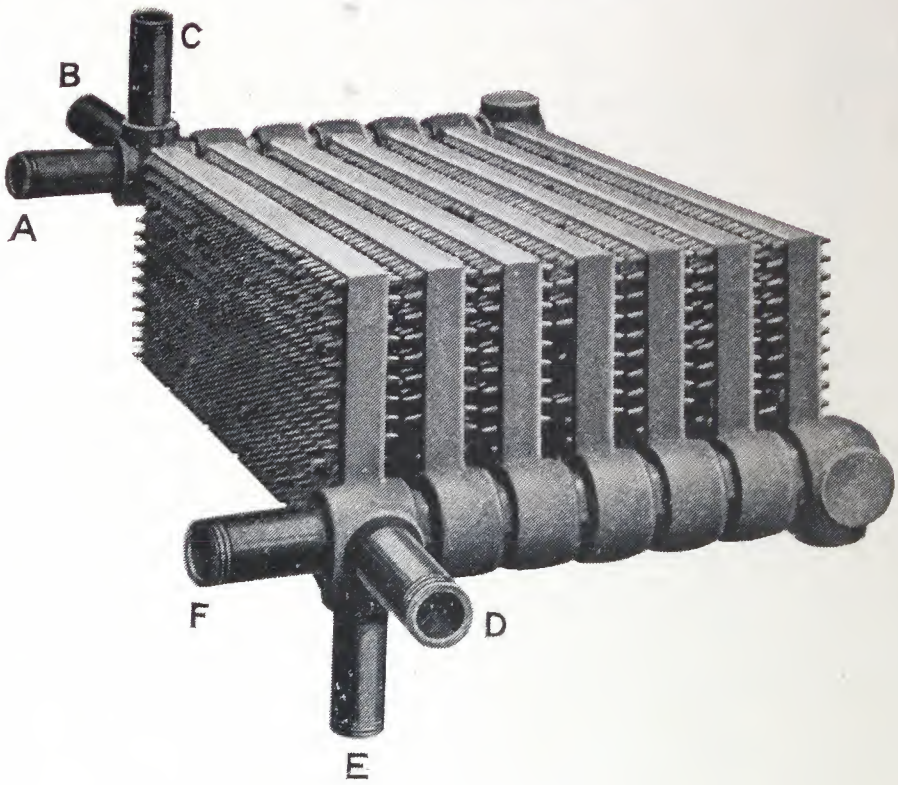
½, 1, 1½, 2, 2½, 3, 3½, 4, 4½ and 5 inches

High Legs

On Special Order only, all styles of our Radiators (except 44 and 45-inch heights) can be furnished with extra high solid legs, for which an extra charge will be made. On 44 and 45-inch heights legs cannot be furnished higher than 6 inches. Other heights can be furnished as high as 10 inches. No charge will be made for 6-inch high legs.

Pin Indirect Radiators

For Steam or Water



Measurements

10 Square Feet per Section

Length of Section Inches	Depth of Section Inches	Depth Over All Inches	Center to Center Between Sections Inches	Free Air Space Between Sections Sq. Ft.
36¼	7¾	8⅝	3	.2703

Maximum tappings 1½″ at A and F, 1¼″ at B, C, D and E.

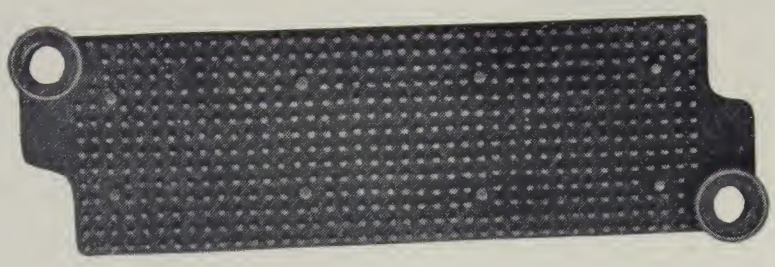
15 Square Feet per Section

Length of Section Inches	Depth of Section Inches	Depth Over All Inches	Center to Center Between Sections Inches	Free Air Space Between Sections Sq. Ft.
36⅝	10⅝	11⅝	3	.2236

Maximum tappings 2″ at A and F, and 1½″ at B, C, D and E.

Pin Indirect Radiators

For Steam or Water



Measurements

20 Square Feet per Section

Length of Section Inches	Depth of Section Inches	Depth Over All Inches	Center to Center Between Sections Inches	Free Air Space Between Sections Sq. Ft.
36	14	14¾	3½	.3494

Maximum tappings 2″ at A, F, B, C, D and E.

Indirect Radiators

TAPPINGS on Indirect Radiators can be made at A, B, C, D, E, or F, but unless otherwise ordered they will be tapped at A and F, as follows:

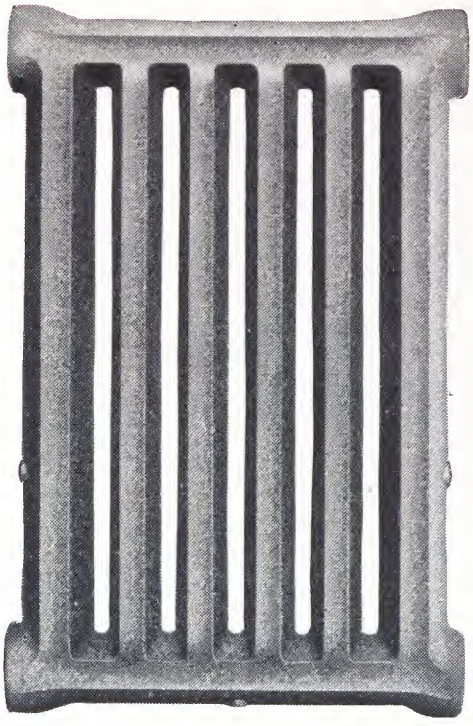
Pin 10-foot section, 1½ inches; Pin 15 and 20-foot, 2 inches; bushed as desired.

All Pin Indirect sections are regularly connected with extra heavy malleable iron push nipples but on special order extra heavy right and left hand screw nipples having hexagon nut at center can be furnished.

Radiator sections are assembled at factory and shipped complete, unless especially ordered otherwise. By assembling at factory the radiators can be thoroughly tested to prevent leaky joints and at the same time save much of fitter's time in setting.

When specially ordered, sections are shipped unassembled with bolts and nipples for putting together, but when so ordering always specify the number of stacks and number of sections in each stack, that the proper bolts may be sent.

Triton Wall Radiators

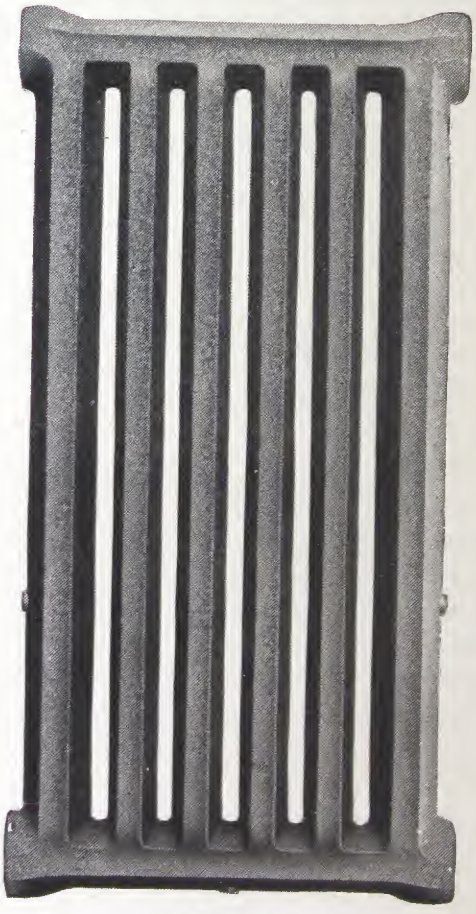


No. 7B

TRITON Wall Radiators should always be assembled with bars vertical, whether sections are built in stacks or tiers. Nos. 5A, 7A and 9A are used when sections are to be assembled end to end, and Nos. 7B and 9B when assembled side by side.

For ratings and measurements see page 77.

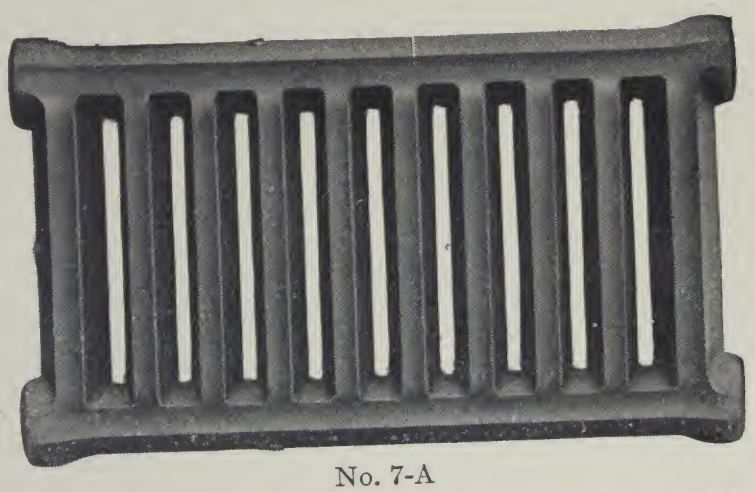
For comparative efficiency tests and methods of assembling see pages 154 to 164.



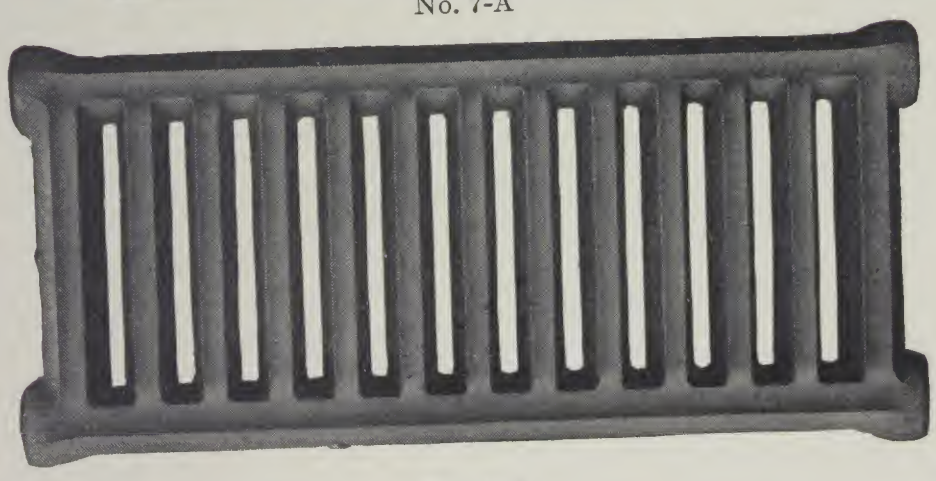
No. 9B

Triton Wall Radiators

No. 5-A



No. 7-A

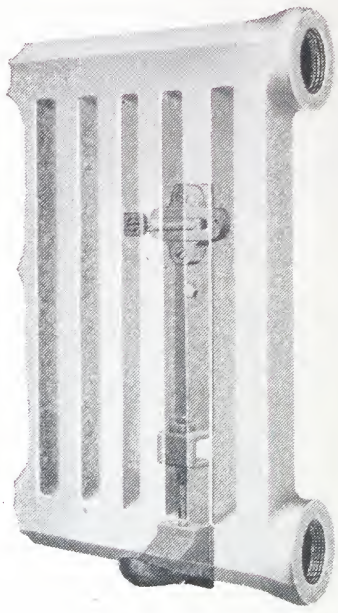


No. 9-A

Section Numbers	Height Inches	Length or Width Inches	Thickness Inches	Thickness With Brackets Inches	Heating Surface Sq. Ft.
5A	14⅛	16½	3	3½	5
7A	14⅛	22⅞	3	3½	7
9A	14⅛	29¼	3	3½	9
7B	22⅞	14⅛	3	3½	7
9B	29¼	14⅛	3	3½	9

Triton Adjustable Wall Brackets

"N"



"O"

TRITON Adjustable Brackets are made to support wall radiators in large or small tiers or stacks in buildings of any character where wall radiation is installed.

They are strong and substantial, and hold radiators securely in place. They are adjusted after attachment to walls by a single expansion bolt.

Triton Adjustable Brackets are made in two styles.

"N" Brackets can be screwed to the wall to support any arrangement of wall radiation.

"O" Bracket, with bearing plate, is attached to wall with one ½" Expansion Bolt, materially reducing the cost of construction and guaranteeing a safe and secure attachment.

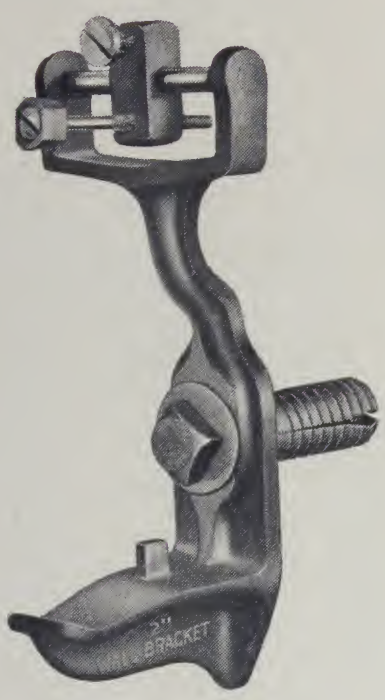
Vertical movement of the seat of "N" and "O" bracket is 2", permitting adjustment for pitch after radiators are erected. The brackets set the outer face of the radiator 4⅞" from the wall.

Screw sizes suitable for use on "N" Bracket:

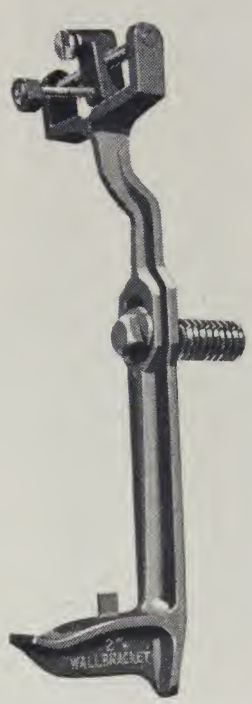
Top Bracket—Size of hole, ¼"—Use No. 14 Wood Screw.
Bottom Bracket—Size of hole, $\frac{9}{16}$"—Use ½" Lag Screw.
"N" Brackets mounted on steel plates.
Top Bracket, ⅜"—Flat Head Machine Screw to fasten to plate.
Bottom Hole, $\frac{9}{16}$"—For ½" Lag Screw to wall.
Bottom Bracket, ⅜"—Machine Screw to fasten to plate.
Bottom Hole—For ½" Lag Screw to fasten to wall.

For additional measurements and chart showing number and location of brackets on assemblages, see pages 165-166.

Barber Wall Radiator Brackets
(Patented)



"A" Type



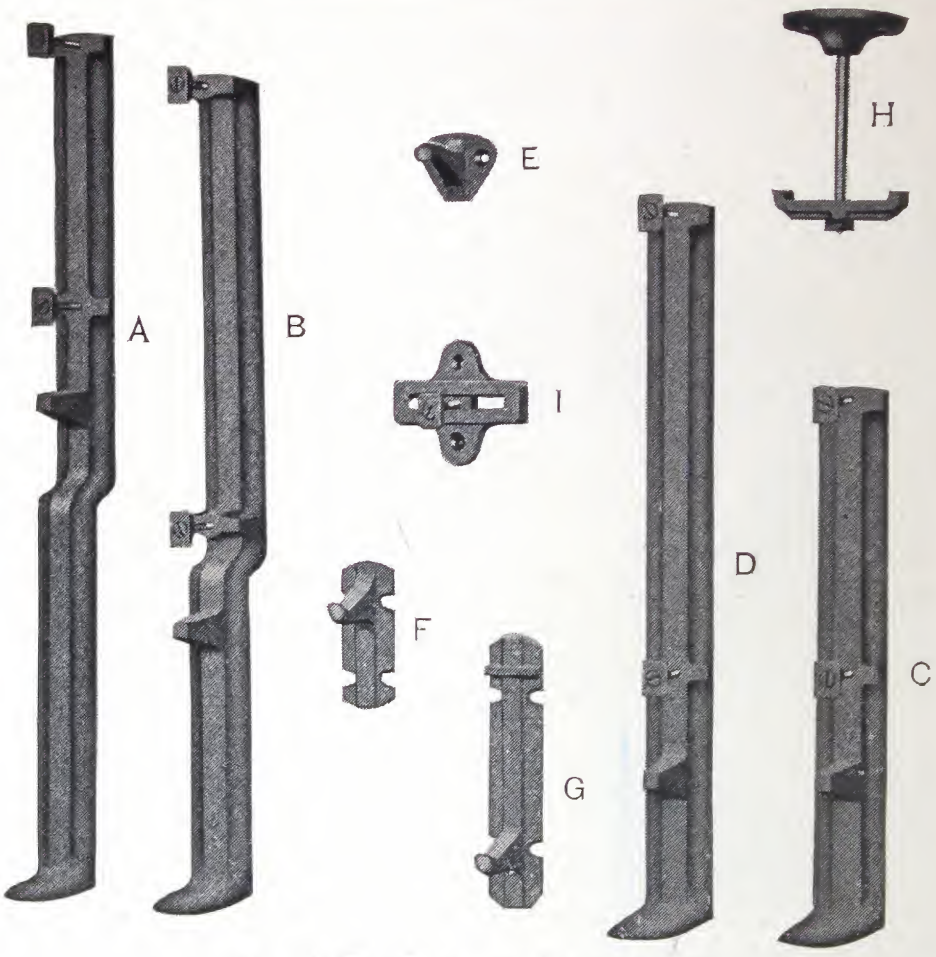
"B" Type

THE Barber Sanitary Wall Radiator Bracket may be used for wood, concrete, brick or tile construction. Is adjustable vertically and allowance is made for free expansion and contraction. Can be placed any height from floor. Only one bolt or lag screw fastens the bracket in place. Made of malleable iron.

"A" Type Bracket is suitable for "A" pattern Wall Radiator.

"B" Type Bracket is suitable for "B" pattern Wall Radiator.

When ordering mention whether "A" or "B" type bracket is desired.



Wall Radiator Brackets

Brackets "B" to fit over a 9½ inch high baseboard for supporting wall radiators Nos. 7-B and 9-B.

Height from Floor to Center of Tapping

No. B 5½ from floor to center..... 5½″
No. B 7½ from floor to center..... 7½″
No. B 9½ from floor to center..... 9½″

Brackets "D" are straight right angle brackets without offset or supporting Nos. 7-B and 9-B. Distance from floor to center of tapping 5½ inches.

Brackets "A" to fit over baseboard for supporting Nos. 5A, 7A and 9A.

Height from Floor to Center of Tapping

No. A 6 will fit over baseboard.....	1½″	6″
No. A 8 will fit over baseboard.....	3½″	8″
No. A 10 will fit over baseboard.....	5½″	10″
No. A 12 will fit over baseboard.....	7½″	12″
No. A 14 will fit over baseboard.....	9½″	14″
No. A 16 will fit over baseboard.....	11½″	16″

Brackets "C" are straight right angle brackets without offset for supporting Nos. 5A, 7A and 9A. Distance from floor to center of tapping 5½ inches.

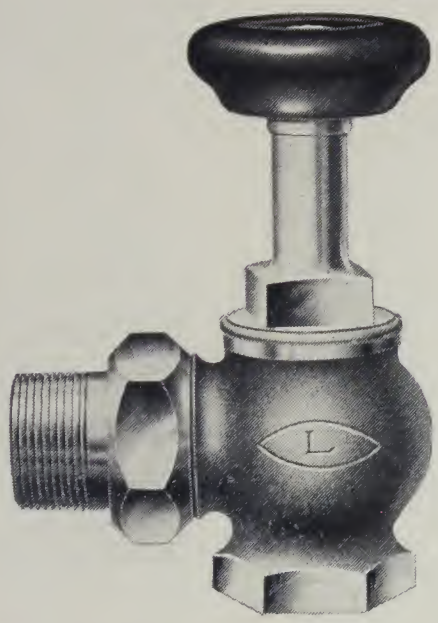
Brackets "F," "G," "E," and "I" are screwed to wall, baseboard and wainscoting. "F" and "G" are bottom supports for all sizes; "E" and "I" top guides to hold radiator in place should always be used with "F" and "G" brackets. "F" and "G" brackets are slotted for four wood screws not furnished by us, and "E" and "I" are for two wood screws.

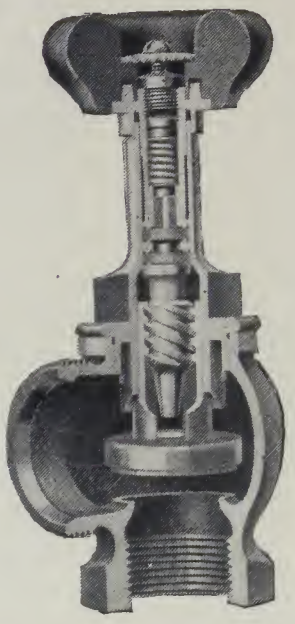
Ceiling brackets "H" for supporting radiator from ceilings, made of cast plate 3⅜ inches in diameter to be screwed to ceiling joist by four screws. Bolt furnished gives a distance of from 3½ to 5 inches from bottom of radiator to ceiling. Other lengths on special order.

With brackets "A," "B," "D" and "C" we furnish two ¼ x 2¼ F. H. stove bolts with button, and with bracket "I" one 1¼ stove bolt with button.

Triton Packless Radiator Valves

For Steam





THE Triton Packless Radiator Valve has a number of decided advantages over any other article of its class. Its packless and quick opening features are simple and efficient and the interior arrangement cannot be injured by ordinary abuse. The bonnet is carried up to the under side of the follower plate to protect the working parts from any outside interference.

By referring to the sectional view, it will be seen that the stem is of the non-rising type and is provided with a flange a short distance above the triple thread. Between this flange and the inwardly extending flange of the bonnet is a specially prepared composition washer. Another similar washer is placed immediately above the inwardly extending flange of the bonnet, and upon this second composition washer rests a gland shaped follower plate extending from the handle. A shoulder is formed on the inside of this follower plate and this shoulder supports a spring which bears upward against a nut screwed to the top of the stem. A double service is performed by this spring, as it bears downward on the upper composition washer and at the same time pulls upward against the lower composition washer, thus holding both of them tightly against the inwardly extending flange of the bonnet and taking up automatically any wear that may occur in either. This insures an absolutely tight joint against water, steam or air. It has the genuine quick opening feature, as it can be fully opened or fully closed and locked closed by about a three-quarters turn of the handle.

With Union, Composition Disc, Rough Body, Plated All Over

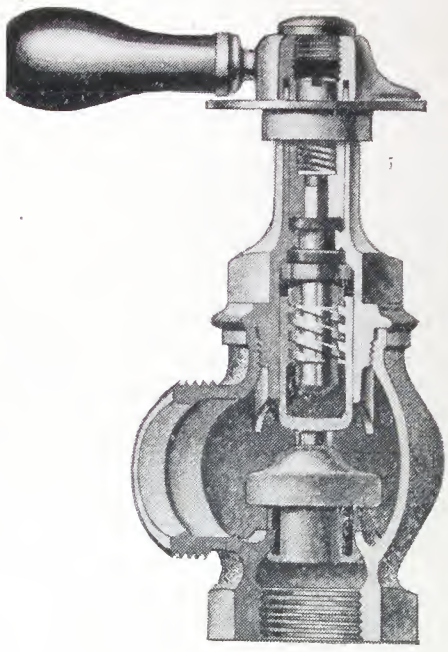
No.	Size, inches.....	½	¾	1	1¼	1½	2
512	Angle.....	$3.15	$3.80	$4.75	$6.40	$8.10	$13.10

On special order can also be furnished with lever handle or lock and shield Plated keys, list 50 cents each extra.

See page 153 for roughing-in measurements.

Triton Graduated Packless Radiator Valves

For Vapor Heating



THE Triton Graduated Packless Valve is similar in construction to the regular packless valve shown on page 81, except that it has a lever handle, an indicator plate graduated into eight sections, and means for special adjustment by which each valve can be accurately set for a wide range of sizes of radiators.

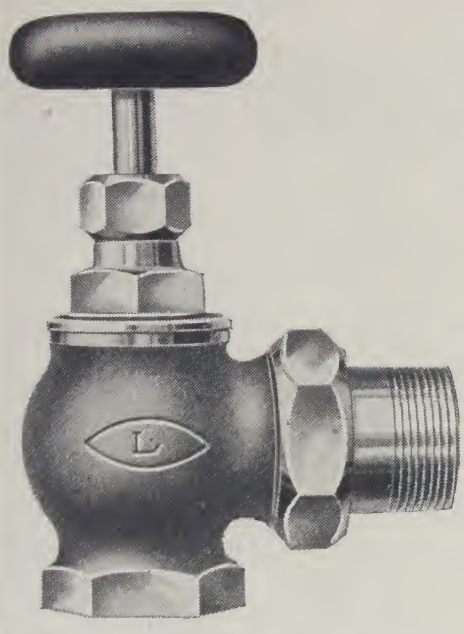
With each valve we furnish four different shells, any one of which may be attached to the disc holder below the disc. If the valve is to be connected to a very small radiator, the shell with the single slot should be used, while if the radiator is of medium or large size, shells with two, three or four slots should be employed. It will remain partly open at any desired position without any danger of variation of the openings unless the handle is moved.

With Union, Composition Disc, Rough Body and Polished Trimmings, Plated All Over

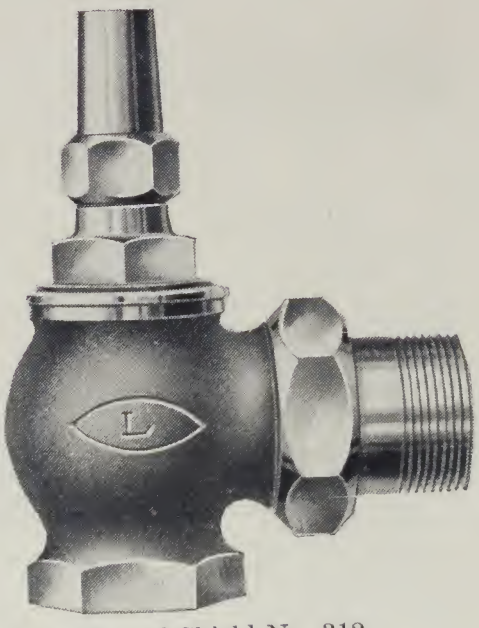
No.	Size, inches.....	½	¾	1	1¼	1½	2
522	Angle Valve, complete with Shells (per cut).....	$3.80	$4.50	$5.50	$7.25	$9.00	$14.30
523	Angle Valve, without Shells..	3.65	4.30	5.25	7.00	8.65	13.90
622	R. H. Corner Valve, complete with Shells.....	4.10	4.90	6.00	7.90	9.85	15.65
722	L. H. Corner Valve, complete with Shells.....	4.10	4.90	6.00	7.90	9.85	15.65
623	R. H. Corner Valve, without Shells.....	3.95	4.70	5.75	7.65	9.50	15.25
723	L. H. Corner Valve, without Shells.....	3.95	4.70	5.75	7.65	9.50	15.25

For roughing-in measurements see page 153. Unless otherwise specified. graduated Packless Valves will be shipped with shells.

Triton Steam Radiator Valves



Nos. 112 and 412



Lock and Shield No. 312

TRITON Steam Radiator Valves embody the best principles of radiator valve construction and design.

Body is a true ball, not cut away to save metal.

Bonnet is cast solid through the square, not cored out.

Stem is large, with a thread which permits a quick opening and closing of the valve.

The distance from bottom of valve to the seat is greater than usual.

Union nut and tail piece are unusually heavy.

When ordering valves specify stock number and size.

With Union Composition Disc—Angle

No.	Size, inches.....	½	¾	1	1¼	1½	2
112	Rough body and polished trimmings, plated all over	$3.15	$3.80	$4.75	$6.40	$8.10	$13.10

With Union, Composition Disc—Angle. Lock and Shield

No.	Size, inches.....	½	¾	1	1¼	1½	2
312	Rough body and polished trimmings, plated all over	$3.15	$3.80	$4.75	$6.40	$8.10	$13.10

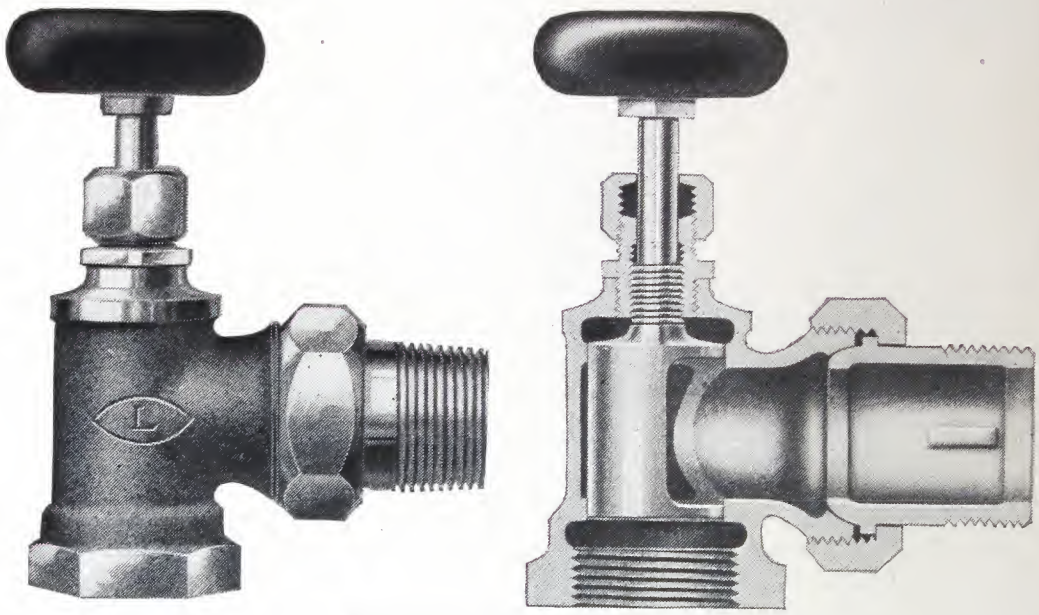
Plated keys, list, 50 cents each extra.

Any of our regular pattern Valves can be fitted with Lock Shield at a small additional charge.

When ordering Keys for Lock Shield Valves specify stock number and size of valves.

See page 153 for roughing-in measurements.

Triton Water Radiator Valves



Patented February 22, 1916

Quick Opening—Bonnetless with Union

THIS patented Hot Water Valve is equipped with shell and stem cast in one piece, which is opened or closed by one-half turn of the handle. The stem is threaded just above the shell to engage with similar thread in packing gland, said gland performing the double function of holding shell in place, as well as raising and lowering the shell when handle is moved. When the stem is turned to the right the shell is revolved and at the same time is pushed downwards, when motion of the shell is reversed, the shell is drawn upwards, thereby doing away with any tendency to stick, after they have remained in one position for some time.

In this construction there are two heavy lugs cast as part of body and other lug cast as part of the shell, making positive stops to stand extra strain in service.

This valve is well proportioned, openings are full size, and each valve is carefully tested and inspected, making it high grade in every respect.

No.	Size, inches	½	¾	1	1¼	1½	2
202	Rough body and polished trimmings, plated all over	$2.40	$2.85	$3.65	$5.05	$7.10	$10.85

On special order can be furnished with lock and shield.

See page 153 for roughing-in measurements.

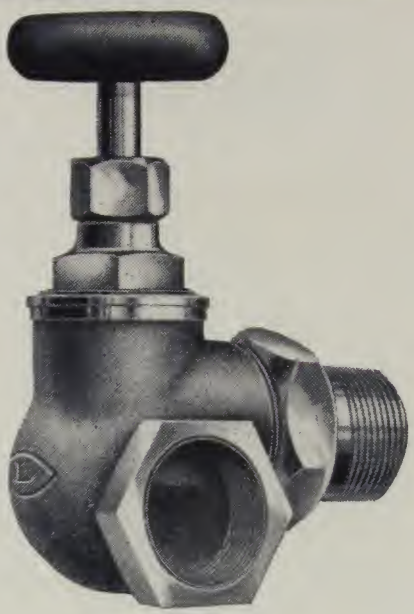
Triton Corner Radiator Valves

For Steam

THESE corner valves are made with large body areas.

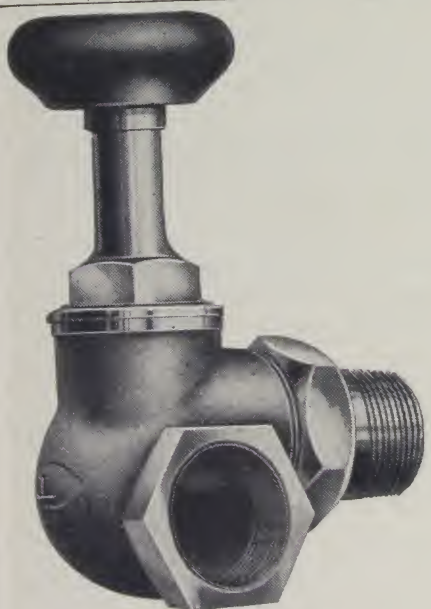
With the exception of the body these valves are identical in construction with our No. 112 Steam Valve on page 83.

With Union, Composition Disc.



No. 212L

No.	Rough body and polished trimmings, plated all over	Size, Inches					
		½	¾	1	1¼	1½	2
212R	Right hand....	$3.45	$4.20	$5.25	$7.05	$8.95	$14.45
212L	Left hand.....	3.45	4.20	5.25	7.05	8.95	14.45



No. 612L

Triton Packless Corner Radiator Valves

For Steam

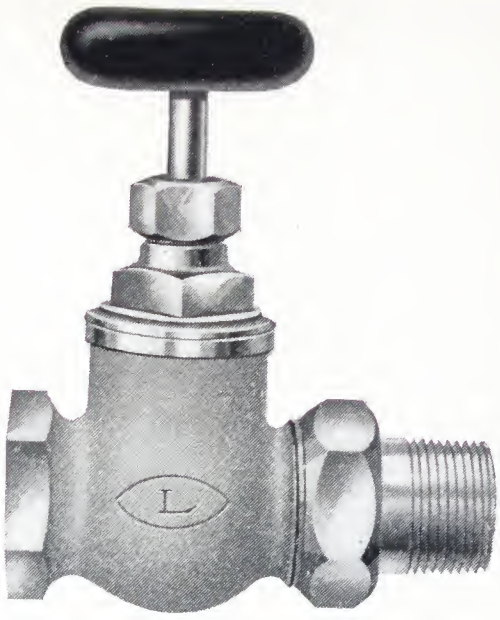
THESE valves are of the same construction as the Packless Valves shown on page 81.

Composition Disc with Union.

No.	Rough body and polished trimmings, plated all over	Size, Inches					
		½	¾	1	1¼	1½	2
612R	Right hand....	$3.45	$4.20	$5.25	$7.05	$8.95	$14.45
612L	Left hand.....	3.45	4.20	5.25	7.05	8.95	14.45

Triton Packless Corner Valves are made in the graduated pattern with lever handle or lock and shield. See page 82 for list.

See page 153 for roughing-in measurements.

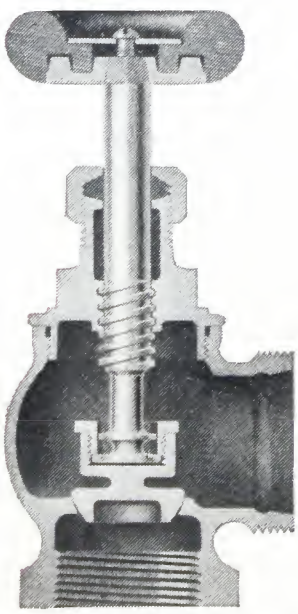


No. 812

Triton Brass Globe Radiator Valves

MADE with large body areas; full openings and liberal threaded space on non-union end. With union, composition disc. Rough body, and polished trimmings. Plated all over.

Size, inches.....	½	¾	1	1¼	1½	2
No. 812.....	$3.15	$3.80	$4.75	$6.40	$8.10	$13.10



No. 412. Sectional View

Triton Steam Radiator Valves

Brass Disc

THE external appearance of this valve is the same as our No. 112, fully described on page 83 of this catalog. When this valve is used on water jobs the disc is drilled for circulation. If desired for water, it is necessary to specify when the order is placed.

With Union—Angle

No.	Size, inches.....	½	¾	1	1¼	1½	2
412	Rough body and polished trimmings, plated all over	$3.15	$3.80	$4.75	$6.40	$8.10	$13.10

See page 153 for roughing-in measurements.

Triton Straightway Valves

No. 200—Brass, double gate, iron wheel, opens to left, non-rising stem, screwed ends.

No. 300—Standard, double gate, iron body, screwed or flanged ends.

NOTE.—Orders for No. 300 must specify whether screwed or flanged ends are wanted.

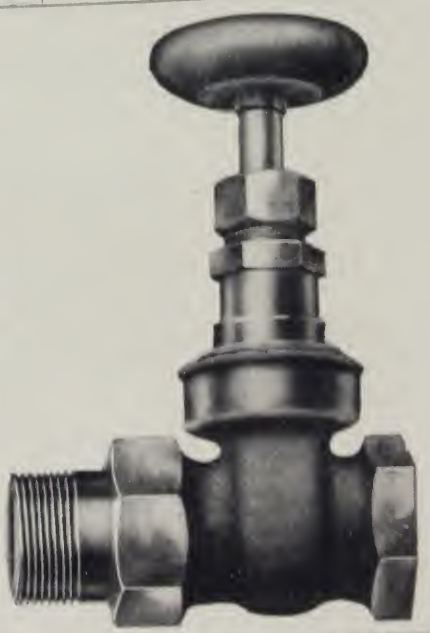
Flanged valves will not be drilled or companion flanges furnished unless so ordered. Flanges and drilling charged extra.

Size, inches	½	¾	1	1¼	1½	2
No. 200	$1.65	$2.05	$2.80	$3.70	$5.00	$7.30
Size, inches	2	2½	3	3½	4	4½
No. 300 screwed	$10.00	$11.50	$14.00	$17.00	$19.00	$24.00
No. 300 flanged	12.00	13.50	16.50	19.50	23.00	28.00
Size, inches	5	6	7	8	10	12
No. 300 screwed	$27.50	$32.50	$45.00	$54.00	$90.00	$125.00
No. 300 flanged	31.50	36.50	49.00	58.00	95.00	133.00

Triton Straightway Radiator Valves

USED for steam or hot water work where straightway connection is desired. Equipped with double brass gate and finished same as regular hot water radiator valves. Opens to the left; non-rising stem.

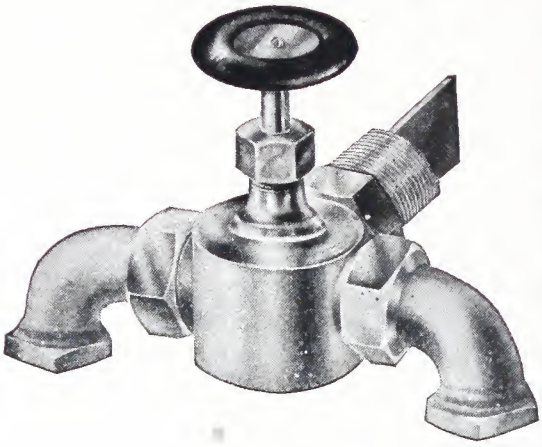
With Union, Rough Body, Polished Trimmings, Plated All Over



Size, inches	½	¾	1	1¼	1½	2
No. 256	$3.65	$4.25	$5.20	$6.60	$9.00	$12.80

On special order, can be furnished with lock and shield.

Triton Unique Water Radiator Valves



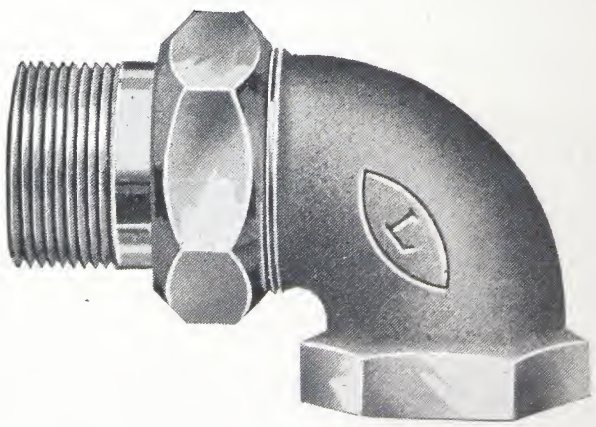
THE use of the Unique Valve does away with the connection at both ends of a water radiator. Its many advantages are apparent, not only for convenience, but in saving fitter's labor and pipe and fittings. Opens and closes with one-sixth turn of the handle.

Rough Body and Polished Trimmings, Plated All Over

No.	Size Inches	Center to Center of Elbows Inches	Center of Body to End of Spud Inches	Center of Spud to Bottom of Elbows Inches	Tapping of Radiator when Valve is Used Inches	Price
480	½	5½	2⅞	1⅞	1¼	$4.25
	¾	5¾	2⅞	1⅞	1¼	5.40
	1	7	3	2	1½	5.80
	1¼	7½	3¼	2⅝	2	7.95

Send for special folder containing full description.

Triton Union Radiator Elbows

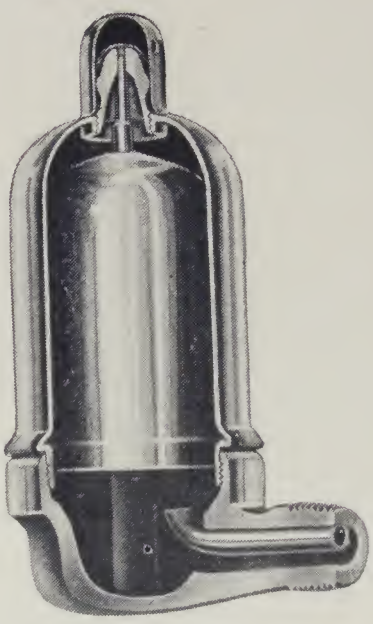


No.	Size, inches	½	¾	1	1¼	1½	2
42	Rough body and polished trimmings, plated all over	$1.75	$2.00	$2.50	$3.20	$4.00	$7.00

See page 153 for roughing-in measurements.

No. 3 Triton Non-Adjustable Automatic Air Valve

Guaranteed for Five Years



THE No. 3 Triton Non-Adjustable Air Valve is an all metal thermostatic valve. The base is made of cast brass, the shell and float are of drawn brass, the valve pin and seat of solid brass rod, and the diaphragm is of bronze. All parts are carefully machined, finished and assembled. No gaskets or packing are used in the manufacture or assembly of this valve. All parts are of metal.

The float contains a volatile liquid which vaporizes when in contact with steam at about 190 degrees F., causing an internal pressure within the float which forces the flexible diaphragm outward, and pushing the float pin into the seat, thereby closing the vent and preventing the escape of steam. If water is forced into the valve the float, being lighter than water, rises and closes the vent port.

The bent tube noticeable in the base (see sectional cut) is for the purpose of allowing air to pass through any water that may be held in the valve, thus equalizing the pressure and permitting the water to flow back into the radiator.

A further feature of the Triton Valve is the extra cap which is soldered to the shell. It frequently happens that the user inserts a pin or other sharp instrument into the vent port of the air valve for the purpose of accelerating air venting and damages the carefully ground float pin and seat. It is to prevent this practice and to eliminate the accumulation of dust in the vent port that the extra cap is attached. The vent port is on the side of the outside cap of the Triton Valve.

The Triton Valve is made in angle pattern only, having ⅛-inch pipe thread connection to radiator.

No. 3 Triton Non-Adjustable Automatic Air Valve, list price each..... $1.75

Weight packed 3 lbs. per doz.

Capitol Automatic Air Valves

No. 1

No. 2

CAPITOL Automatic Air Valves have combination float and expansion post.

When water enters the valve the float is lifted until the pin closes the vent hole. The float drops as soon as the water leaves the valve.

When steam enters the valve the post is expanded by the heat and forces the float upward, closing the valve against the emission of steam.

The valve body is made of brass, nickel-plated and highly finished. The post is made of highly sensitive composition.

The bottom connections of the No. 2 valve make it particularly adapted for indirect Radiators, Coils, etc.

Both valves threaded for ⅛″ tapping. Can furnish No. 2 valve with ¼″ tapping if required.

No. 1 Capitol	Weight 3 lbs. per doz.	Price each.....$0.75
No. 2 Capitol.	Weight 3 lbs. per doz.	Price each..... 1.00

Triton Fractional Radiator Valves

U. S. R. Steam Control Valve

No. 15

THE U. S. R. Control Valve regulates the amount of steam to radiator. Turn indicator to Open and permit steam to enter one, two or as many sections of the radiator as desired, then turn back to Shut.

When used in conjunction with Triton Fractional Radiators and special Automatic Air Valve (see below) for recessed sections, control valve should be kept closed in mild weather, and radiator will automatically heat to recessed section. In cold weather, when it is necessary to heat the entire radiator, leave the valve in Open position, and it will function automatically.

Construction—Composition expanding member reinforced with inner brass tube. Corrugated Float with ball joint valve seat. Heavy cast brass duplex base with separate passage for air and water.

Guaranteed five years.

No. 20 Valve and
No. 21 Ell

The Special Triton Straight Shank Automatic Air Valve, with short radius street elbow, is especially adapted for use on Triton Fractional Radiators.

Construction—In the shell of the Valve is a sealed metal float. This float contains a Volatile Liquid which vaporizes when steam reaches the float, expanding the corrugations top and bottom, closing the Valve against loss of steam.

Guaranteed five years.

No. 15 U. S. R. Steam Control Valve, list price, each.....$4.00
⅛″ angle pipe thread connection.

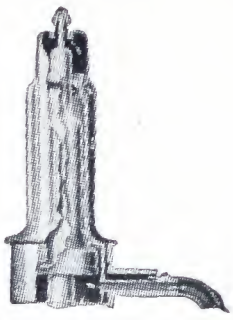
No. 20 Triton Special Automatic Air Valve, list price, each... 2.00
¼″ straight shank pipe thread connection.

No. 21 Special Radius Street Elbow, list price, each..... .50
Rough brass, nickel plated—¼″ male and female pipe thread connection.

Refer to page 71 for Triton Fractional Radiators.

Hoffman Venting Valves

The Hoffman Line is a "Complete Line" of venting valves for every type of steam system.



No. 1

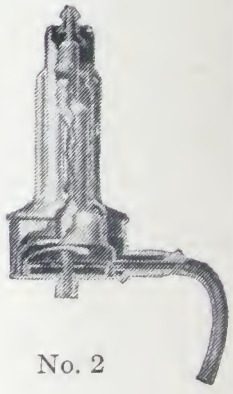
The No. 1 Hoffman Siphon Air Valve is designed for systems of the one pipe gravity type. Through its use all air is vented from the radiator without loss of steam, maximum heating efficiency is assured and leakage from waterlogged radiators prevented. After contact of water with the valve the siphon drains all water from the valve and venting occurs even if radiator is under pressure.

No. 1 Hoffman Siphon Air Valve with ⅛" connection. List price.....$1.90

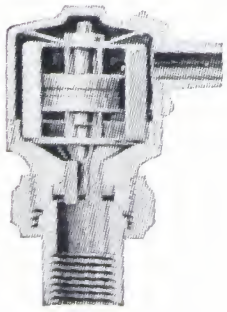
The No. 2 Hoffman Siphon Air and Vacuum Valve is similar in construction to the No. 1, but in addition, when the radiator is once freed from air, return of air through the vent port is prevented.

Through its use an ordinary one pipe steam system may be changed into a vacuum type.

No. 2 Hoffman Siphon Air and Vacuum Valve with ⅛" connection. List price.....$4.50



No. 2

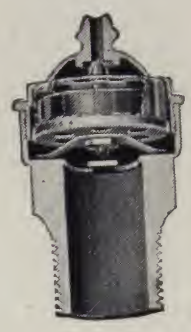


No. 3

The No. 3 Hoffman Air Line Valve is a compact well constructed valve for Air Line, or as they are frequently termed, "Paul" Systems. It is sensitive in action and closes the instant steam fills the radiator. No adjustment is necessary either before or after installation.

No. 3 Hoffman Air Line Valve, radiator connection ⅛" male, with ¼" union connection. List price..... $2.50

Hoffman Venting Valves—Continued



No. 4

The No. 4 Hoffman Quick Vent Valve is designed for use in venting risers or return mains where water will not come in contact with the valve. All air is freely vented through a 1/8" vent port without steam loss but valve will not prevent escape of water.

No. 4 Hoffman Quick Vent Air Valve, standard connection 3/4" can also be supplied with 1/4" connection. List price $2.80

No. 5

The No. 5 Hoffman Quick Vent Float Air Valve is of the triple duty type intended for venting return mains, indirect stacks and for use under all conditions where water is present in the system. It vents all air, closes tightly against steam and prevents escape of water through vent port.

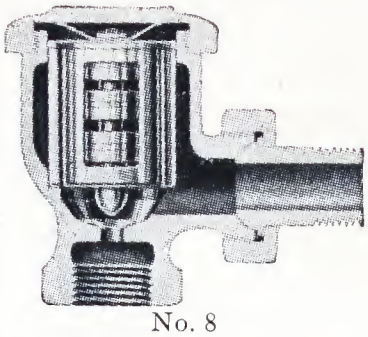
No. 5 Hoffman Quick Vent Float Air Valve, 3/8" pipe connection; furnished with 3/16" port for pressure below 3 lbs.; 1/16" port for 3 lbs. or over. List price $8.00

No. 6

The No. 6 Hoffman Quick Vent Float Air and Vacuum Valve is similar in design to the No. 5 Valve with the addition of the diaphragm in the base of the valve which prevents intake of air through the valve port. The valve should be used for venting return lines in vapor-vacuum work or wherever return of air to the system is not desirable.

No. 6 Hoffman Quick Vent Float Air and Vacuum Valve, pipe connection 3/8"; vent port for less than 3 lbs. is 3/16"; for 3 lbs. and over use 1/16" port. List price $12.00

Hoffman Venting Valves—Continued



No. 8

The chief feature of Hoffman Return Line Valves is their consistency of operation within a pressure range from 13″ vacuum to 50 lbs. pressure. By means of a special thermostatic fluid a constant relationship between fluid and steam pressures is always maintained; insuring sensitive action whenever air or water reaches the valve. These valves may be used as steam traps in industrial work.

No. 8 Hoffman Return Line Valve with ½″ connections, suitable for 200 sq. feet of radiation, made in angle, straightway, right and left offset patterns. List price, all patterns $6.00

No. 9 Hoffman Return Line Valve with ¾″ connection, suitable for 600 sq. ft. of radiation, made in angle pattern only. List price $8.00

No. 10

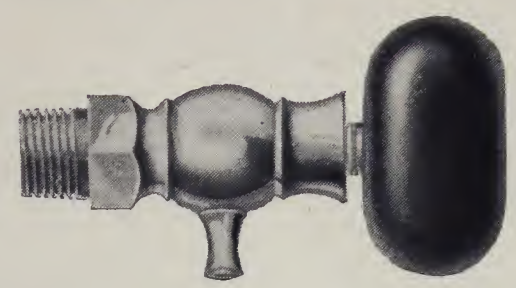
No. 10 Hoffman Vapor Valve is used for venting large systems. Valve has ¾″ valve ports which are controlled by a float and separate thermostat, the combination preventing escape of steam or water.

No. 10 Hoffman Vapor Valve with ¾″ vent port, ¾″ pipe connection. List price $25.00

The Hoffman Equalizing Loop maintains a constant differential pressure between steam main and return line. It insures a constant water line in boiler by preventing water from backing up into return line.

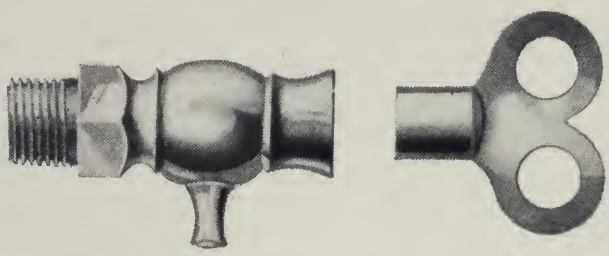
The Hoffman Equalizing Loop with 1¼″ pipe connections. List price $35.00

Compression Air Valves



The Drip Connection is screwed into the body of the Valve

No. 8. Wood Wheel, nickel-plated, list price per dozen.....$3.00
(Weight packed 1¼ lbs. per doz.)



The Drip Connection is screwed into the body of the Valve

No. 9. With Key, nickel-plated, list price per dozen, including two Keys.....$2.50
(Weight packed 1 lb. per doz.)

Extra Keys, list price each..... .10

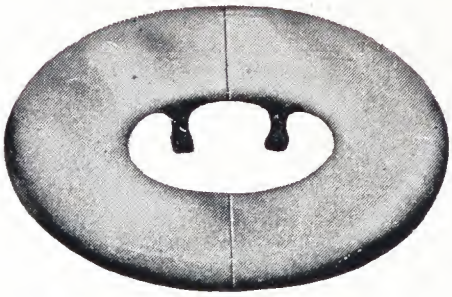
No. 10. Positive and automatic, nickel-plated, per dozen....$3.00
(Weight packed ¾ lbs. per doz.)

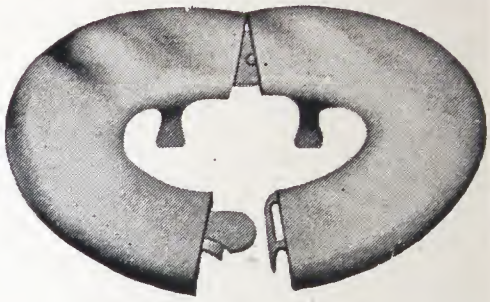
This valve can be used with equal facility as a positive or an automatic air valve without change or adjustment. It operates very quickly and will last a lifetime. Fully guaranteed.

All above valves threaded for ⅛-inch tapping.

Floor and Ceiling Plates

Capitol





THE Capitol Floor and Ceiling Plate is one of the strongest and neatest now on the market. Made of cold rolled steel, coppered before nickel plating, halves securely riveted by a concealed hinge. Can be opened or closed on pipe without effort.

For pipe.....	⅜″	½″	¾″	1″	1¼″	1½″	2″	2½″	3″	3½″	4″
Nickeled, each...	$0.26	$0.27	$0.28	$0.32	$0.35	$0.38	$0.45	$0.65	$0.80	$1.00	$1.25
Black, each.....	.15	.16	.17	.20	.22	.25	.30	.50	.65	.80	1.00
Weight per doz. Boxed (lbs.)...	¾	1	1	1½	1¾	2	2¼	2¾	3¼	4	4½

Triton

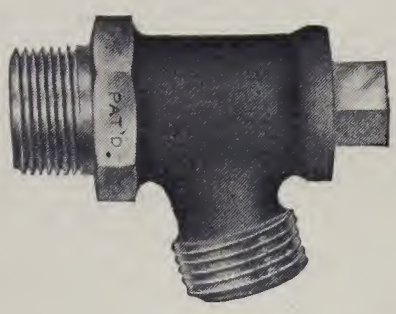
A heavy stamped steel adjustable floor and ceiling plate; handsome in design and substantially constructed.

It is held firmly to the pipe by four jaws, stamped to conform to the pipe.

This plate cannot be equalled in finish by any plate on the market; it is nickeled on copper and highly polished.

For pipe.....	½″	¾″	1″	1¼″	1½″	2″	2½″	3″
Nickeled, each.....	$0.27	$0.28	$0.32	$0.35	$0.38	$0.45	$0.65	$0.80
Black, each.....	.16	.17	.20	.22	.25	.30	.50	.65
Weight per doz., Boxed (lbs.).....	¾	¾	1¼	1½	2	2¼	2½	3

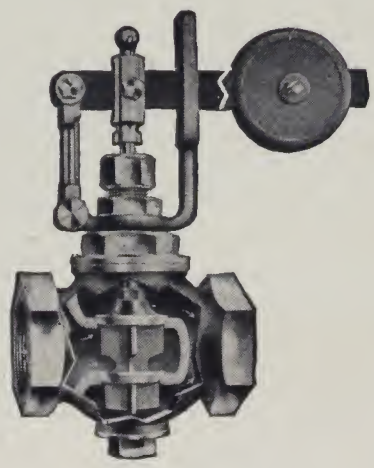
Capitol Boiler Draw-off Cocks



THIS patent stop draw-off cock is made so that the plug cannot be removed. Furnished in ½ or ¾-inch sizes, with ¾-inch hose thread connection.

No. 70. ½-inch, list each.....$0.75
No. 71. ¾-inch, list each..... .75

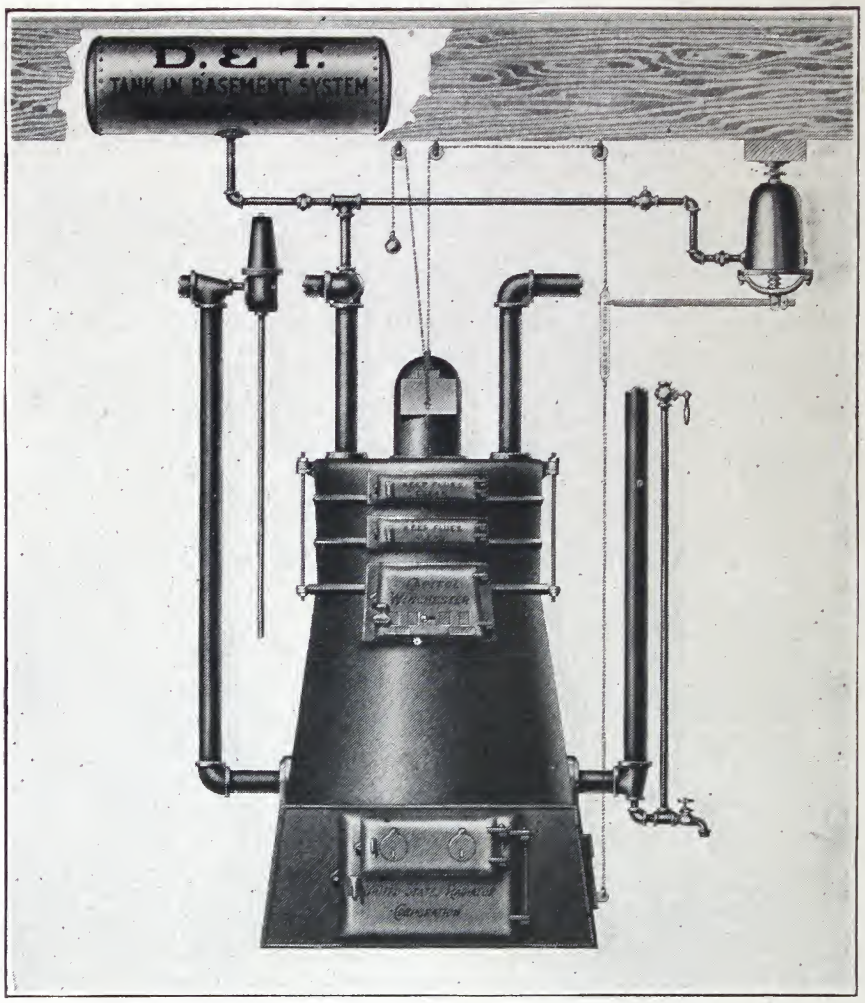
Capitol Regulating Valves



VERY widely used for the control of steam, water, air or gas. Especially suitable for use in connection with heat-regulating devices. Also recommended for any service where an extremely sensitive and positive action is necessary. The areas of the body and all openings are full size, and are of such form to insure an unobstructed passage. Made with two bevel seat discs. The upper opening is slightly larger to permit the lower disc to pass. No matter what the pressure, only a slight movement of the float is required either to open or close the valve.

Size, inches	½	¾	1	1¼	1½
Brass, screwed	$5.50	$5.50	$6.00	$7.25	$9.00
Size, inches	2	2½	3	3½	4
Brass, screwed	$15.00	$21.00	$34.00	$50.00	$65.00
Iron body, screwed	.....	.....	32.00	40.00	50.00

D. & T. Tank-in-Basement System of Hot Water Heating



Material Furnished with D. & T. System

1 Air tight expansion tank.

1 Pressure gauge.

1 Air sealed relief controller.

1 Diaphragm regulator.

Adjustment plate, chains, pulleys, and necessary trimmings.

Use No. 2 Regulator for one and two-story buildings.

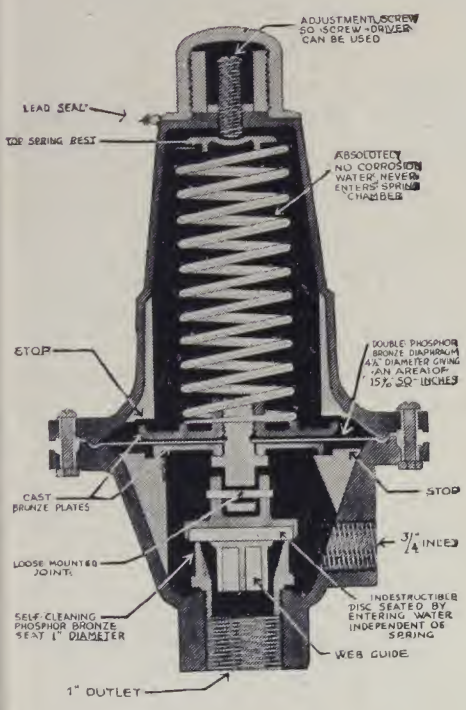
Use No. 3 Regulator for three-story buildings.

Use No. 4 Regulator for four-story buildings.

List price No. 2, No. 3 and No. 4 D. & T. system up to 1,400 square feet of radiation, $60.00. Installation containing more radiation than 1,400 square feet, additional charge will be made for extra tank capacity.

Special circular on application.

D. & T. Perfection Water Relief and Vacuum Valve



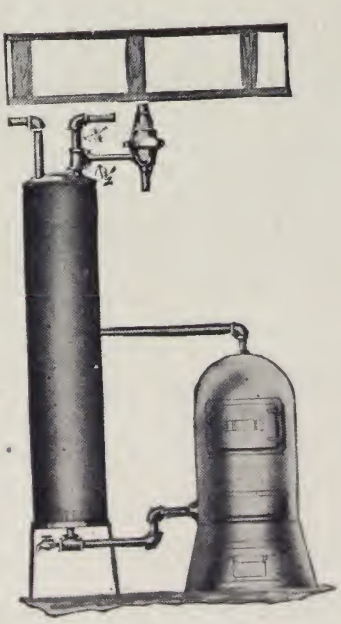
THE D. & T. Perfection Water Relief and Vacuum Valve is designed for use with domestic water systems. It can be set from 40 pounds to 120 pounds pressure.

Disc being loosely mounted, should a city water main be shut off, or if the drain cock in the basement is shut off and a vacuum be formed in the tank, this valve will open up immediately.

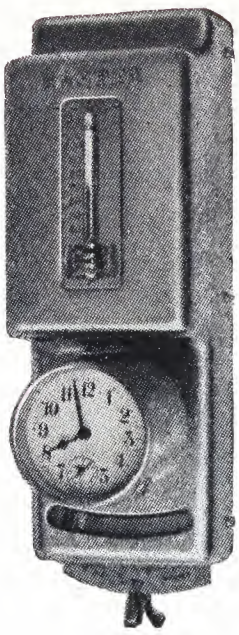
CUT illustrates the D. & T. Perfection Water Relief and Vacuum Valve in connection with tank heater tapped inlet ¾ inch, outlet 1 inch.

List price (Shipping Weight 10 lbs.) $12.00

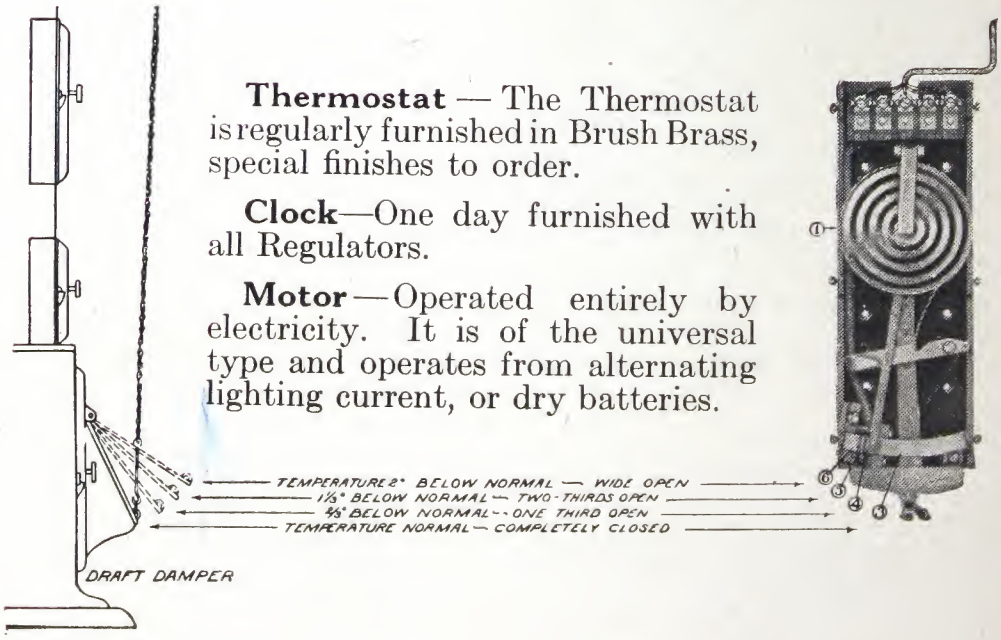
Special circular on application.



The Master Heat Regulator



THE advantages of the **Master Heat Regulator** are provided through the use of Four Positions of the Dampers—Closed, one-third open, two-thirds open, and wide open. The "Master" by virtue of its Intermediate Damper Positions gives the Dampers an opening equal to the Draft actually required and closes them, step by step, as the Temperature approaches the desired point.



Thermostat — The Thermostat is regularly furnished in Brush Brass, special finishes to order.

Clock—One day furnished with all Regulators.

Motor—Operated entirely by electricity. It is of the universal type and operates from alternating lighting current, or dry batteries.

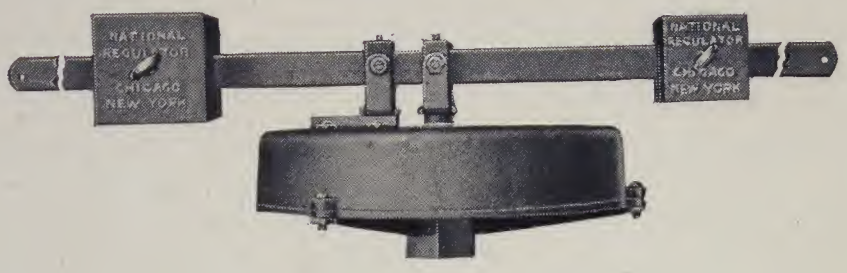
List Prices

Master Heat Regulator—Direct current for use on dry batteries, list price $60.00

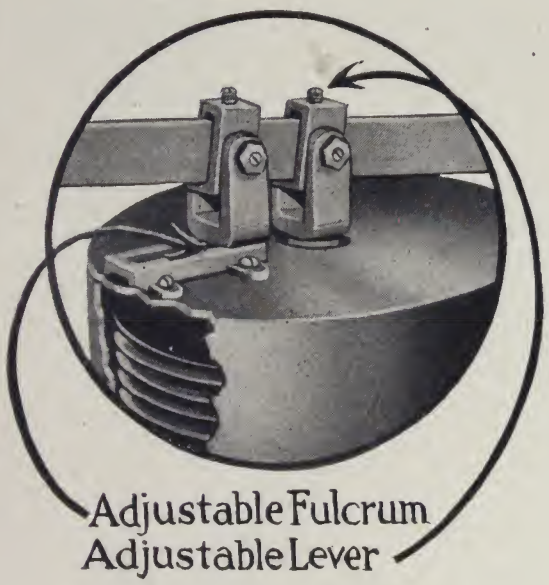
Alternating current, including transformer, list price 70.00

Metaphram Damper Regulators

For Steam and Vapor



METAPHRAM Steam Damper Regulators are all metal, dust proof, compact, powerful and very sensitive.



The universal adjustment feature makes them applicable for pressure or vapor by changing fulcrum position and shifting the weight and lever. They will fit any style of low pressure boiler and work on ounces from zero up to and not exceeding fifteen pounds pressure.

No. A. 4-inch. For low pressure.....List $15.00
Boiler connection, ½-inch. Shipping weight, 15 lbs.

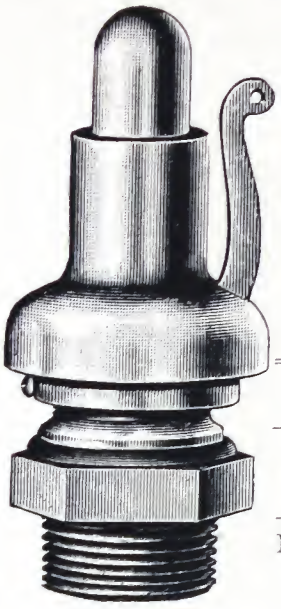
No. BC. 7-inch. For low pressure or vapor.....List $20.00
Boiler connection, 1-inch. Shipping weight, 35 lbs.

No. D. 10-inch. For Vapor.....List $27.00
Boiler connection, 1-inch. Shipping weight, 55 lbs.

Nos. A. 4″ and BC. 7″ regulators are equipped with weights and chains.

No. D. 10″ regulators are equipped with bell cranks, which not only greatly reduce friction, but insure greater sensitiveness to the regulator.

The adjustable fulcrum feature applies to the BC. 7″ and D. 10″ regulators only.



Brass Pop Safety Valves
With Iron Base

THIS low pressure pop safety valve is well proportioned and its construction includes all the features necessary to make it reliable and efficient.

Regularly set at 15 pounds.

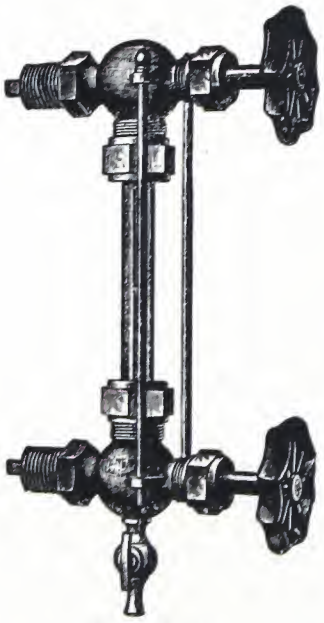
Can be drilled for seal without extra cost.

Size, inches. Finished body.

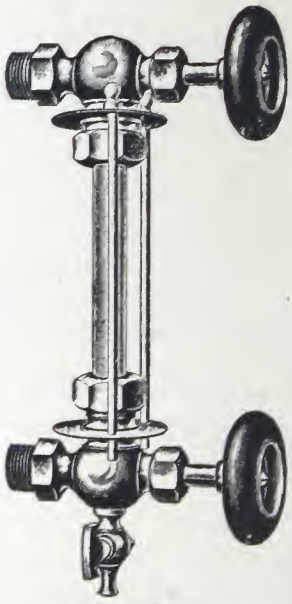
1	1¼	1½	2	2½	3	3½	4	4½
$6.00	$6.75	$8.25	$11.25	$26.00	$37.50	$50.00	$80.00	$100.00

NOTE—See safety valve data, page 196.

Brass Water Gauges
Self Cleaning



11 and 14



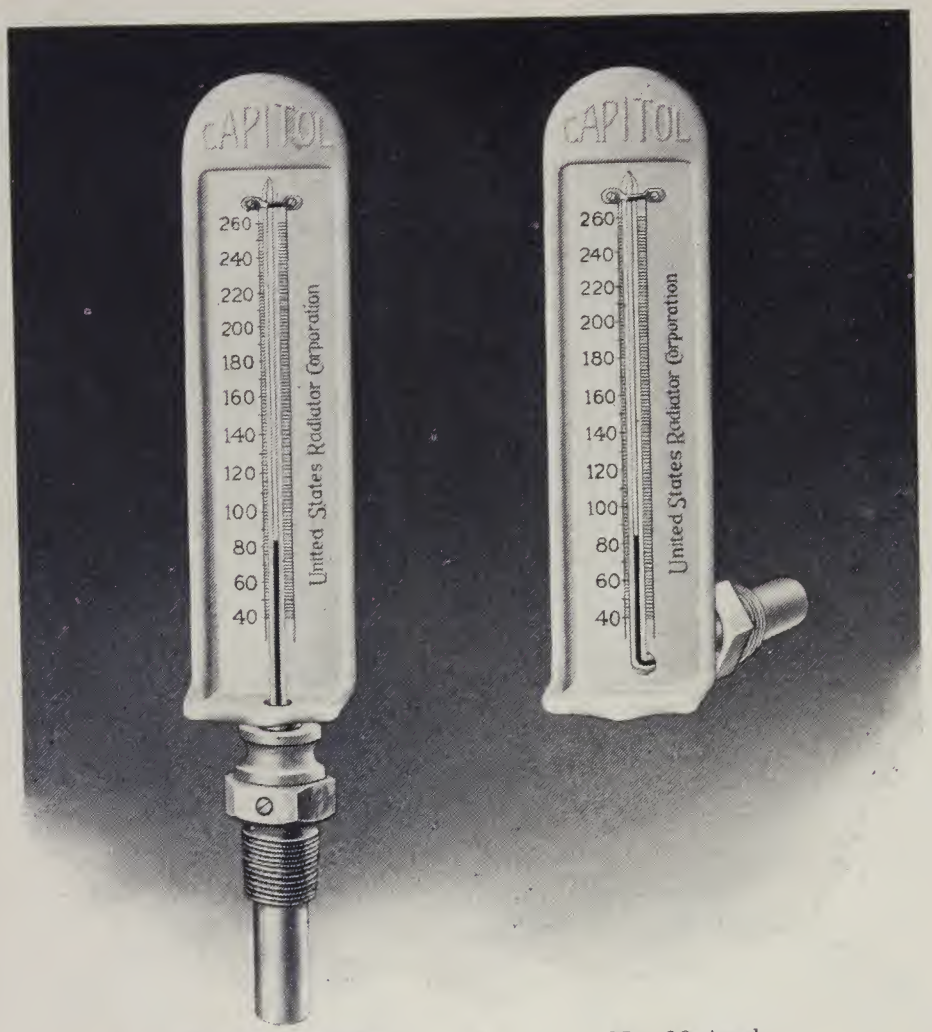
13 and 15

Number	Body	Wheels	Connections Iron Pipe Size, Inches	Size of Glass	List per Set
11	Rough, Bronzed..	Iron	½	⅝ x 12	$3.00
13	Polished.....	Wood	½	⅝ x 12	4.25
14	Rough, Bronzed..	Iron	¾	¾ x 16	4.50
15	Polished.....	Wood	¾	¾ x 16	5.50

Compression Gauge Cocks
Without Stuffing Box

No. 40 Wood Handle, threaded for iron pipe, ⅜-inch, list each, $0.85
No. 44 Wood Handle, threaded for iron pipe, ½-inch, list each, .90

Capitol Hot Water Thermometers



No. 10 Straight No. 20 Angle

THE Capitol Hot Water Thermometer will record temperatures accurately and quickly. Care should be taken to be sure that the metal tube surrounding the glass bulb is thoroughly immersed in the hot water. Lower part of the tube is immersed in a mercury bath.

If face does not set in right position when tightened, loosen the screw on the tail-piece, turn face to correct position without lifting, then tighten screw.

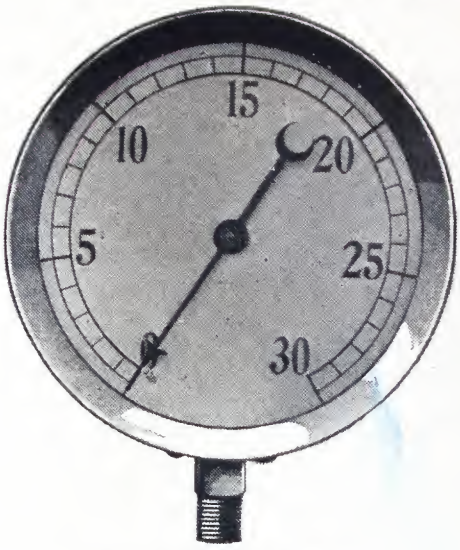
Regularly furnished with red spirit liquid, which indicates the temperature more clearly than thermometers made up with mercury columns.

Case is stamped steel, white enameled.

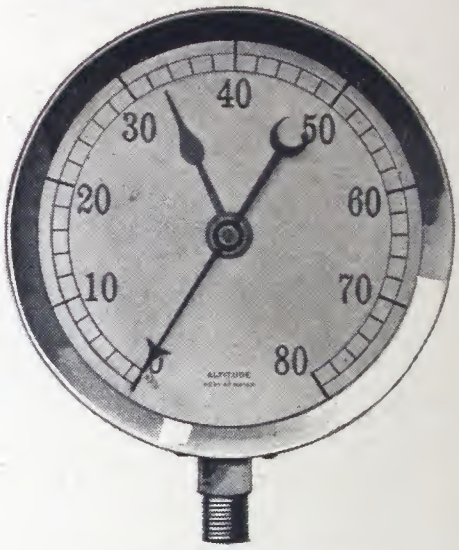
Each thermometer tested before leaving the factory and carefully packed. Threaded for ½-inch tapping.

No. 10 Straight. Weight packed 1¼ lbs., price each $1.70
No. 20 Angle. Weight packed 1¼ lbs., price each 2.00

Capitol Gauges



No. 41 Steam Gauge



No. 42 Altitude Gauge

No. 41 Steam Gauge registers pressure up to 30 pounds, movement made of non-corrosive metal. We can supply high pressure gauges when required. (Prices on application.)

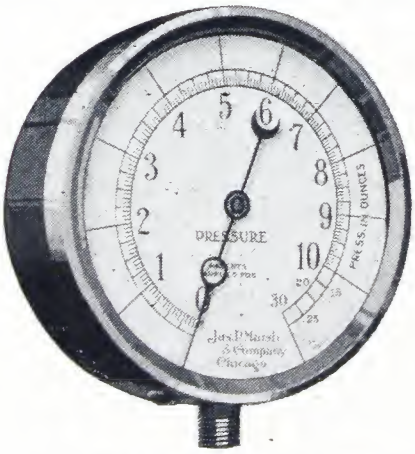
List price each without cock, (Weight boxed 3 lbs.).....$3.50

No. 42 Altitude Gauge indicates accurately, at the boiler, the height of water in the system. To set: When the water is at the proper level in the expansion tank remove the ring and glass and set the red hand at the pressure indicated by the working hand. Water should be added as soon as the operating hand falls below the red hand.

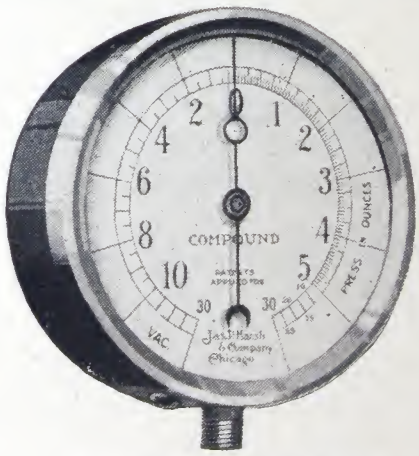
List price each with cock, (Weight boxed 3 lbs.).....$4.00

No. 45 Compound Gauge (not illustrated) registering pressure to 30 lbs. and vacuum to 30″.

List price each without cock, (Weight boxed 3 lbs.).....$5.00



No. 43 Low Pressure Gauge



No. 44 Compound Gauge

No. 43 Low Pressure Gauge—registering in ounce graduations up to 10 lbs. or less, then with protected and retarded travel from 10 to 30 lbs.

List price each with cock, (Weight boxed 3 lbs.).....$8.00

No. 44 Compound Gauge—registering pressure in ounce graduation up to 5 lbs., the degree of vacuum in half-inch depths to 10″, then with protected and retarded travel. Pressure from 5 to 30 lbs., vacuum from 10″ to 30″.

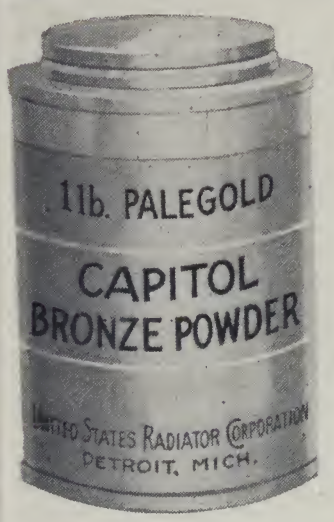
List price each with cock, (Weight boxed 3 lbs.).....$12.00

Specifications all Gauges—4½″ dial, mounted in neat, plain black case, with nickel plated ring. Threaded ¼″.

NOTE—A siphon should be used with Gauges Nos. 41, 43, 44 and 45.

Capitol Bronzes

WE have devoted considerable study to the question of offering the trade a line of Radiator Bronzes that would recommend itself after it had once been used. Our strongest effort has been to furnish the best values, considering carefully the rich and brilliant finish, amount of covering capacity and lasting qualities.



Directions For Use

BRONZES—Use a bronze primer, or if you want to finish a job quickly, give the radiator first a coat of bronzing liquid; this will dry in about twenty minutes with a gloss, covering up all the dirt and rust. Then mix the bronze powder with the bronzing liquid to the consistency of cream and apply evenly, that is, in one direction only. Always use a soft brush, as a stiff brush cuts the bronze ruining the high finish. If bronze is applied when radiator is warm, the lustre is improved.

One pound of gold or color bronze requires one quart of liquid and will cover from 250 to 300 square feet of radiation.

One pound of aluminum bronze requires about one gallon of liquid and will cover from 500 to 600 square feet of radiation.

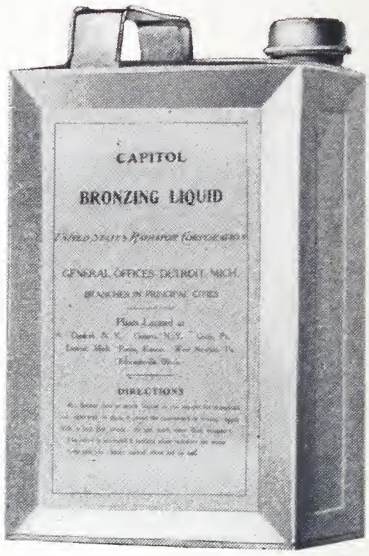
Capitol Bronze Powders

	List, Each
Pale Gold, one-pound cans	$2.00
Rich Gold, one-pound cans	2.00
Pure Metal Leaf, one-pound cans	2.50
(Pure Metal Leaf Bronze is the highest grade of pale gold, unrivalled in brilliancy and permanency of tone and color.)	
Aluminum, one-pound cans	2.50
Aluminum, half-pound cans	1.75
(Aluminum Bronze guaranteed chemically pure.)	
Green, one-pound cans	2.50
Maroon, one-pound cans	3.00
Chocolate, one-pound cans	3.00
Copper, one-pound cans	2.50
Fire, one-pound cans	2.50

To get best results we recommend the use of Capitol Bronzing Liquid.

We can furnish on application, color card showing above and other special colors.

Capitol Bronzing Liquid



A LIQUID for use in mixing with gold, aluminum or other bronze powders; to act as a vehicle for them and a binder to the surface over which they are applied. The color is so light that it has no effect on the most delicate bronze tints, and the body is such that it does not interfere with the lustre of the bronze itself.

When liquid is not in use, keep can tightly covered, otherwise evaporation takes place, thickening the liquid and making it unusable. Mix only in clean cans. Put up in gallon, half gallon and quart cans.

Capitol Bronze Primer

Especially made for use on radiators, as it does not contain any material of non-radiating nature. It is used as a filler, making a smoother surface and reducing the amount of bronze necessary for the work. Furnished in same size cans as bronzing liquid.

Capitol Maroon Japan

Makes an attractive finish at a low cost, dries quickly with a high gloss which is not affected by heat. Recommended for use on radiators in public places where durability counts. Supplied in gallon, half-gallon and quart cans.

Capitol Radiator Enamel

An Air Drying Enamel

ESPECIALLY made for use on radiators, where a hard, heat-resisting, durable finish is required. All colors are permanent, and will not crack, chip or shrink.

Made in the Following Colors

White
Ivory
Oak Brown
Black
Silver Gray
Light Blue
Navy Blue
Light Green
Dark Green
Moss Green
Vermillion
Maroon
Goeblin Blue

Put up in one gallon, half-gallon and one quart cans.

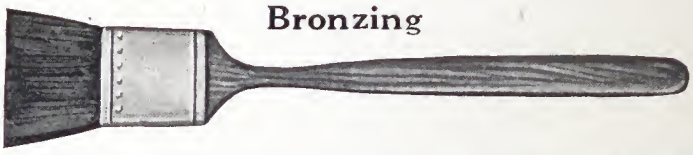
One gallon will cover about 250 square feet of surface. Regularly supplied in Gloss Finish.

Black Asphaltum

FOR painting Boilers, Castings, Steam or Water Pipes, etc. Of great covering capacity and very durable. Regularly sold in one gallon cans. Special price quoted on barrel lots.

Capitol Brushes

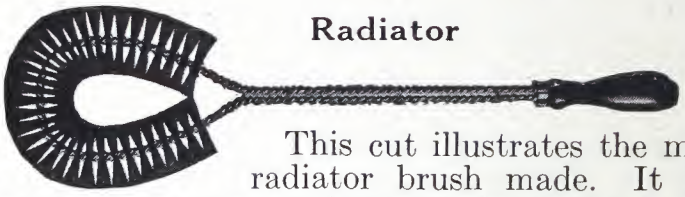
Bronzing



CAPITOL Bronzing Brushes have extra long handles, making them most practical for easily bronzing radiators. The bristles are of fine quality, especially suited for high grade work.

1-inch, each,	$0.40	2-inch, each	$0.60
1½-inch, each,	.50	2½-inch, each,	.70

Radiator



This cut illustrates the most advanced radiator brush made. It has no wood parts to break, the bristles are held securely and it is otherwise very durable. The shape and size make it possible to remove any accumulation of dust from the interior surface of the radiator with one motion of the brush. Also handy for cleaning between spindles of stairway, under heavy furniture or in out of the way corners.

Capitol Radiator Brushes, list each..... $0.80

Flue

Number	Description	Price List
1	Round wire, 3 inches diameter.....	$1.00
2	Round wire, 3 inches diameter, same as No. 1, except with 55-inch flexible wire handle.....	1.20
3	Flat tempered wire, 2 x 3¼ inches oval sides...	1.30
4	Flat tempered wire, 3 x 4 inches oval sides.....	1.40
5	Double brush, 1¾ x 4½ x 4 inches.....	1.50
6	Double brush, 2½ x 6 x 4 inches.....	2.00
7	Round end, fine wire, 1¼ inches diameter.....	1.00
8	Round end, fine wire, 1½ inches diameter.....	1.00
9	Reinforced, rectangular, 7 x 3 x 3 inches.....	2.50

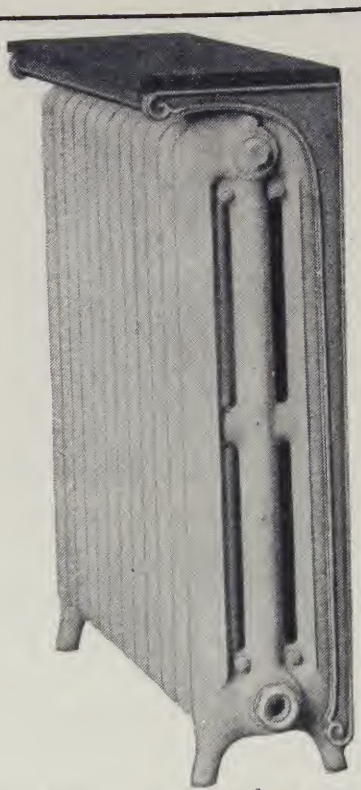
Capitol Radiator Shields

Marble Top Type

TOPS of Marble, choice of Tennessee, Georgia, Alabama, Vermont, Italian, Carthage and Kasota Marbles.

Also furnished in PREMIER TYPE with tray top edged with polished brass truss into which is fitted Clear Plate Glass, White Carrara Glass, Black Carrara Glass, or fancy and highly colored decorative marbles. With Clear Plate Glass cretonne, damask or tapestry inserts are used.

Made to fit all sizes and styles of radiators. All shields made special and orders not subject to cancellation.



Marble Top showing dust retainer

Price List and Sizes for Marble Top Shields

No. of Sections in Radiator	With Dust Retainer				Without Dust Retainer			
	1 Column and Wall	2 Column	3 Column	4-6 Column	1 Column and Wall	2 Column	3 Column	4-6 Column
3-6	20.17	20.62	23.98	27.72	17.17	17.53	20.36	23.95
7	21.77	22.31	25.62	29.72	18.49	18.66	21.74	25.28
8	23.54	24.18	27.23	32.03	19.98	20.57	23.12	27.22
9	24.92	25.57	28.97	34.20	21.17	21.72	24.62	29.06
10	26.48	27.11	30.62	36.60	22.50	23.05	26.03	31.10
11	27.60	28.32	32.21	39.04	23.46	24.07	27.38	33.18
12	29.34	29.77	33.74	41.64	24.92	25.28	28.26	35.39
13	30.46	31.20	35.57	43.96	25.86	26.52	30.23	37.37
14	31.66	32.46	36.78	46.37	26.92	27.60	31.25	39.61
15	32.78	33.61	38.46	48.26	27.74	28.34	32.68	41.02
16	33.77	34.60	39.90	50.68	28.68	29.40	33.89	43.08
17	34.64	35.54	41.05	52.66	29.42	30.19	34.50	44.74
18	35.68	36.35	42.01	55.10	30.34	30.91	35.71	46.84
19	36.37	37.22	43.16	57.58	30.91	31.63	36.68	48.94
20	36.96	37.92	43.97	59.48	31.40	32.23	37.37	50.51
21	37.66	38.57	44.74	61.30	31.99	32.57	38.03	52.10
22	38.17	39.17	45.46	63.12	32.44	33.29	38.64	53.74
23	38.71	39.55	46.07	64.92	32.90	33.73	39.13	55.18
24	39.17	40.14	46.70	66.58	33.29	34.12	39.68	56.58
25	39.71	40.57	47.22	68.32	33.73	34.48	40.13	58.07
26	40.22	41.22	48.02	69.61	34 20	35.03	40.82	59.28
27	40.82	41.89	48.84	71.17	34.69	35.60	41.82	60.42
28	41.56	42.54	49.60	72.48	35.30	36.16	42.17	61.61
29	42.06	43.14	50.24	73.61	35.71	36.65	42.70	62.57
30	42.59	43.67	50.93	74.52	36.37	37.13	43.27	63.35

PRICES FOR PREMIER SHIELDS FURNISHED ON APPLICATION

For shields longer than 30 sections, add $1.00 to the list for each extra section. Prices are for unpainted shields. If shields are to be finished in gold, aluminum or copper bronze, or in enamel colors, add $4.00 to the list price for each shield.

When ordering give name of radiator, height, number of sections, number of columns, width of sections, center to center of sections and center to center of end sections.

Triton Radiator Shields

Supermetal Type

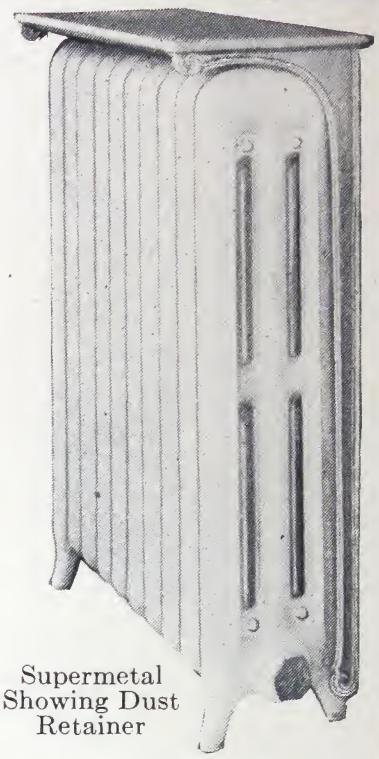
TOPS of re-enforced steel plate with rounded metal edging.

Metal shields are also made in the following types:

Metal Top—without dust retainer, made for all heights and sizes.

Flare Top—without dust retainer, made in full, medium and short length.

All shields made special and orders not subject to cancellation.



Supermetal Showing Dust Retainer

Price List and Sizes for Supermetal Shields

No. of Sections in Radiator	With Dust Retainer				Without Dust Retainer			
	1 Column and Wall	2 Column	3 Column	4-6 Column	1 Column and Wall	2 Column	3 Column	4-6 Column
3-6	15.72	16.07	18.68	21.61	13.37	13.66	15.88	18.68
7	16.96	17.38	19.96	23.16	14.41	14.54	16.95	19.70
8	18.34	18.84	21.22	24.96	15.57	16.03	18.03	21.21
9	19.42	19.93	22.56	26.65	16.49	16.93	19.18	22.64
10	20.63	21.11	23.86	28.51	17.54	17.96	20.27	24.24
11	21.51	22.06	25.09	30.43	18.29	18.75	21.33	25.84
12	22.86	23.18	26.29	32.43	19.42	19.70	22.31	27.57
13	23.74	24.31	27.70	34.25	20.15	20.67	23.55	29.12
14	24.67	25.29	28.66	36.13	20.98	21.51	24.33	30.87
15	25.55	26.20	29.97	37.59	21.70	22.09	25.46	31.96
16	26.31	26.96	31.08	39.48	22.48	22.91	26.42	33.57
17	26.99	27.70	31.99	41.03	22.92	23.53	26.89	34.87
18	27.80	28.32	32.73	42.93	23.63	24.08	27.83	36.50
19	28.35	28.99	32.64	44.86	24.08	24.64	28.58	38.12
20	28.80	29.56	34.26	46.35	24.48	25.13	29.12	39.35
21	29.35	30.06	34.87	47.77	24.92	25.38	29.64	40.61
22	29.74	30.51	35.42	49.17	25.28	25.93	30.11	41.87
23	30.15	30.82	35.89	50.57	25.63	26.28	30.50	42.99
24	30.51	31.28	36.39	51.87	25.93	26.58	30.94	44.09
25	30.95	31.61	36.80	53.23	26.28	26.85	31.27	45.25
26	31.35	32.12	37.42	54.25	26.65	27.29	31.80	46.20
27	31.80	32.65	38.05	55.44	27.04	27.74	32.59	47.08
28	32.38	33.15	38.65	56.47	27.50	28.18	32.87	47.99
29	32.78	33.61	39.66	57.35	27.83	28.57	33.27	48.75
30	33.18	34.02	39.69	58.06	28.35	28.93	33.73	49.36

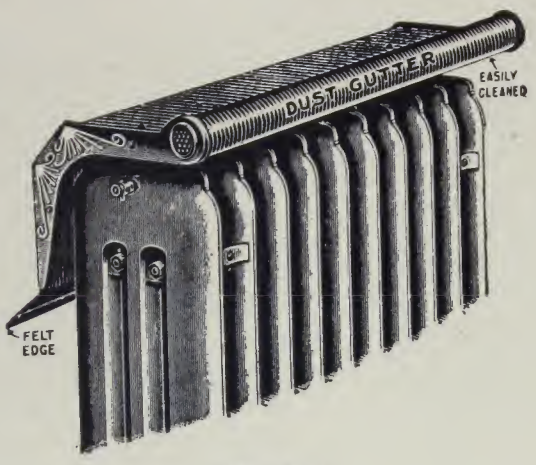
PRICES FOR METAL TOP AND FLARE TOP SHIELDS FURNISHED ON APPLICATION.

For shields longer than 30 sections add $1.00 to the list for each extra section.

Prices are for unpainted shields. If shields are to be finished in gold, aluminum or copper bronze, or in enamel colors, add $4.00 to the list price for each shield.

When ordering give name of radiator, height, number of sections, number of columns, width of sections, center to center of sections and center to center of end sections.

Hawkins Radiator Shields



STYLE C

HAWKINS Radiator Shields—very effective, neat in appearance, adjustable to any radiator. Are made in five widths to properly cover all radiators from three to thirteen inches in width.

Price List

Subject to Discount

STYLE A—Flat top Hood and Adjustable Apron of heavy crimped sheet iron, with solid cast iron Ends and slip-apart Supports, for radiators 20 inches long and over, undecorated, per inch	$0.25
STYLE B—Sloping Hood and Adjustable Apron of heavy crimped sheet iron, with solid cast iron Ends and slip-apart Supports, for radiators 20 inches long and over, undecorated, per inch	.20
STYLE C—Flat top Hood and Apron of heavy crimped sheet iron, with solid cast iron Ends and Supports, for radiators 20 inches long and over, undecorated, per inch	.15
SHEET IRON APRON EXTENSION to within about 3 inches of floor, for radiators 20 inches long and over, undecorated, per inch	.10
Gold or aluminum bronzing either of the three style shields, for radiators 20 inches long and over, per inch	.06
Removable Water Pan, including solid cast iron frame and lid, for radiators, six sections or more long and two columns or more in width	4.00

Any of the above shields or apron extensions for radiators under 20 inches in length will be charged same as 20 inch.

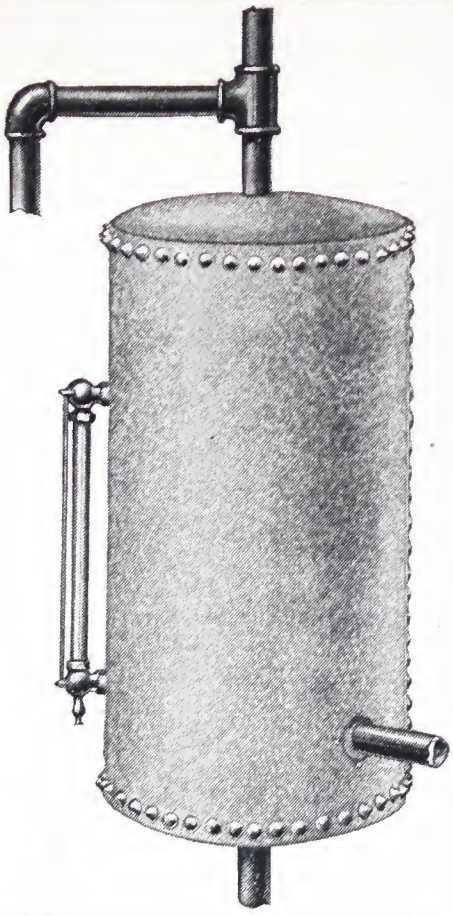
We extend our shields about 1½ inches over each end of radiator, but only charge for the net length of radiator.

Crating charged at cost.

Water pan is made for Style A and Style C Shields only.

In ordering, give name or make of radiator if possible, number of sections or loops in each radiator, number of columns in each loop or section, length of radiator, width, and distance of radiator from wall, height of radiator (in ordering shields fitted with extension apron).

Orders not subject to cancellation.



Capitol Expansion Tanks

TAPPED at top for 1-inch overflow pipe; at bottom for 1-inch expansion pipe; at side for water supply. Water gauge tappings ½" —13½" between centers.

Made from a superior grade of heavy boiler steel, riveted and galvanized.

Are to be preferred in every case to the ordinary tanks of light iron, which are liable to collapse and have no durability.

Capacity Gallons	Size Inches	Square Feet of Radiation	Price Each Without Trimmings	Price Each Complete With Trimmings
8	10 x 20	250	$ 7.50	$ 9.25
10	12 x 20	300	8.00	9.75
15	12 x 30	500	9.00	10.75
20	14 x 30	700	12.50	14.25
26	16 x 30	950	14.00	15.75
32	16 x 36	1300	15.00	16.75
42	16 x 48	2000	16.50	18.25

NOTE 1.—Horizontal Expansion Tanks can be furnished on special order.

NOTE 2.—Expansion Tanks larger than 42 gallon capacity can be made to order.

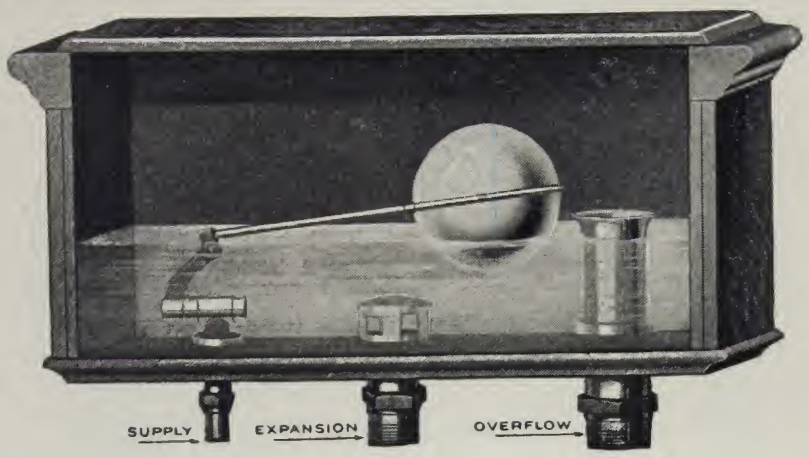
Capitol Expansion Tank Brackets

EASIER and cheaper to install than building a shelf. It can be adjusted for all sizes of tanks from 10 to 16 inches in diameter. Furnished with necessary screws.

Weight, 5½ pounds.

List price each, complete, $1.75.

Capitol Automatic Expansion Tanks



3/8″ 1¼″ 1½″

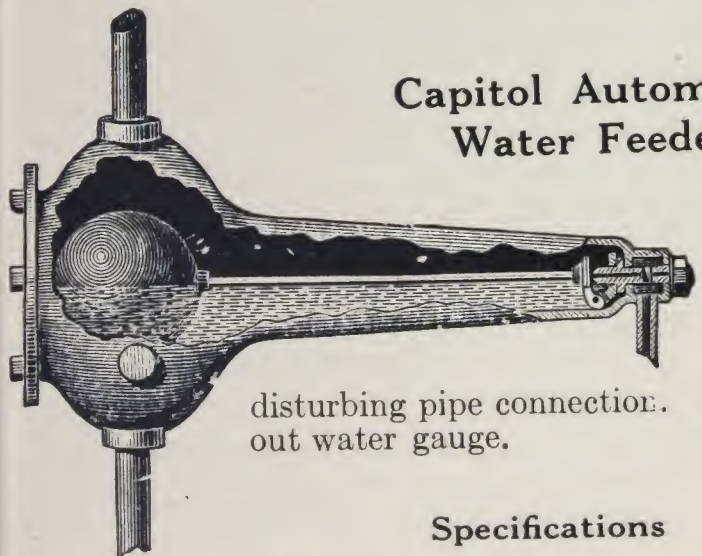
USED in connection with hot water systems, they insure a full supply of water, at the same time taking care of the overflow. Made of hard wood, lined with sheet copper and furnished with cast brass fittings. Neither gauge glass nor altitude gauge is needed with them and with their use there is no danger of freezing when placed in attic or out of the way closet.

Inside measurements are:

Length, 20 inches. Width, 9 inches. Depth, 10 inches.

Can be used on any hot water job containing up to 3,000 feet of radiation.

No. 302, Plain Oak, varnished, square corners, price each $20.00. On special order can be finished in mahogany at extra charge of $2.00 each, net. Shipping weight, 30 lbs.



Capitol Automatic Water Feeders

FOR automatically controlling the water level of low pressure heating boilers. Can be cleaned without disturbing pipe connection. Supplied with or without water gauge.

Specifications

Height, 12 inches. Length, 24 inches. Width, 10 inches.

Boiler connection, 1 inch. Feed water inlet, ¾ inch.

No. 61 without gauge. Shipping weight, 50 lbs. Price each, $25.00

No. 62 with gauge. Shipping weight, 65 lbs. Price each... 30.00

Steel Storage Tanks

With or Without Coils

SHOWS horizontal tank with location of regular tappings. The size and style of tapping can be varied to meet all special conditions.

Data

All list prices on storage tanks herein include regular tappings.

Regular tappings consist of six 2″ reinforced tapped openings.

All tappings (reinforced or with flanges) more than six 2″ reinforced, will be charged as extra.

Tanks without manhole have the heads therein placed convex and concave.

Tanks with manhole have both heads placed convex.

Orders for tanks of special construction, or tanks furnished with coils, are not subject to cancellation.

When ordering, state whether vertical or horizontal tanks are wanted. Unless otherwise ordered, tanks without coils, manholes or handholes will be shipped. We recommend that tanks containing coils also have manhole placed in head.

All standard storage tanks are tested to a hydrostatic pressure of 100 pounds to the square inch, and are guaranteed for a working pressure of 65 pounds per square inch.

All extra heavy storage tanks are tested to a hydrostatic pressure of 150 pounds to the square inch, and are guaranteed for a working pressure of 100 pounds per square inch. All longitudinal seams double riveted.

Tanks used in water systems where a sudden or unusual pressure may occur beyond the 65 pounds working pressure indicated above, should be fitted with pressure reducing valve.

Supports for horizontal and vertical tanks can be furnished.

Steel Storage Tanks

Standard and Extra Heavy

Manufacturers' Standard List Prices

Size Inches	Capacity Gallons	Standard Shell 3/16"; Heads 1/4" — Approximate Shipping Weight	Standard Shell 3/16"; Heads 1/4" — Regular Openings Inches	Standard Shell 3/16"; Heads 1/4" — List Price Black and Galvanized	Extra Heavy Shell 1/4"; Heads 5/16" — Approximate Shipping Weight	Extra Heavy Shell 1/4"; Heads 5/16" — Regular Openings Inches	Extra Heavy Shell 1/4"; Heads 5/16" — List Price Black and Galvanized
20x 48	66	270	1½	$ 94.00	....	...	.....
20x 60	85	310	1½	104.00	....	...	.....
24x 48	100	320	1½	109.00	....	...	.....
24x 60	120	380	1½	123.00	390	1½	$137.00
24x 72	140	440	1½	134.00	440	1½	155.00
30x 48	150	430	2	143.00	...	...	.....
30x 60	180	500	2	158.00	520	2	182.00
30x 72	220	555	2	173.00	590	2	198.00
30x 84	250	630	2	196.00	660	2	224.00
30x 96	295	700	2	211.00	720	2	242.00
36x 72	315	700	2	206.00	920	2	264.00
36x 84	365	780	2	241.00	1030	2	300.00
36x 96	420	870	2	256.00	1160	2	328.00
36x120	525	1030	2	293.00	1380	2	385.00
42x 72	430	890	2	276.00	1140	2	345.00
42x 84	500	980	2	310.00	1260	2	390.00
42x 96	575	1070	2	333.00	1400	2	420.00
42x120	720	1250	2	375.00	1660	2	480.00
42x144	865	1430	2	415.00	1910	2	540.00
42x168	1000	1620	2	468.00	2180	2	614.00
48x 96	750	....	...	.....	1690	3	510.00
48x120	940	....	...	.....	1960	3	580.00
48x144	1130	....	...	.....	2250	3	650.00
48x168	1300	....	...	.....	2570	3	715.00
48x192	1500	....	...	.....	2860	3	800.00
48x216	1700	....	...	.....	3150	3	870.00

Coils for Storage Tanks

A STANDARD coil is one constructed of Return Bends and made of four pipes. The list prices below provide for placing coil in tank, properly braced and secured.

Tank Size	Number of Pipes	Size Coil Inches	Plain Coil	Galvanized Coil	Brass Pipe (I. P. S.)
20x 48	4	1	$29.00	$35.00	Quoted on Application
20x 60	4	1	30.50	38.50	
24x 48	4	1¼	35.50	42.00	
24x 60	4	1¼	37.00	45.00	
24x 72	4	1¼	38.50	48.00	
30x 48	4	1¼	35.50	42.00	
30x 60	4	1¼	37.00	45.00	
30x 72	4	1¼	38.50	48.00	
30x 84	4	1¼	40.00	51.00	
30x 96	4	1¼	41.50	54.00	
36x 72	4	1½	51.00	62.00	
36x 84	4	1½	54.00	66.00	
36x 96	4	1½	57.50	70.00	
36x120	4	1½	64.00	78.00	
42x 72	4	1½	51.00	62.00	
42x 84	4	1½	54.50	66.00	
42x 96	4	1½	57.50	70.00	
42x120	4	1½	64.00	78.00	
42x144	4	1½	70.50	85.00	
42x168	4	1½	77.00	93.00	

List Price

Manholes, Handholes and Extra Flanged Openings

2 inch Flange, each	$ 8.00
2½ inch Flange, each	8.00
3 inch Flange, each	9.00
3½ inch Flange, each	9.00
4 inch Flange, each	10.00
Manholes in head, each	30.00
Manholes in shell, each	45.00
Handholes in head, each	8.00
Handholes in shell, each	8.00

It is advisable to have a manhole in head of all tanks containing coils. It should be remembered when figuring. Quotations will upon application be promptly furnished on styles and sizes of coils other than above.

Capitol Auxiliary Heaters

THESE cast-iron heaters are a perfect substitute for the old style pipe coils formerly placed in the combustion chamber for heating water for domestic purposes. They have a greater efficiency by reason of the divided circulation than is possible in any other form and at the same time do not interfere with the draft.

Can be used in furnaces and stoves for heating rooms out of reach of hot air pipes; for heating range boilers, heating water by steam, also for superheating steam and heating compressed air.

Made in iron and brass. When iron rust in hot water is to be avoided, we recommend the use of the brass section.

All sizes, except the 5″, can be furnished with side inlets at an addition of $3.00 to list prices for the 6″ and 8″ sizes and $4.00 to list prices for all other sizes.

Size Inches	Height Inches	Tapping Inches	Capacity Square Feet	Price List Iron	Price List Brass	Shipping Weights Lbs.
5	3	1	30	$ 3.25	$ 8.50	5
6	3	1	35	3.60	9.00	5
8	4½	1¼	75	7.00	22.00	12
12	6	2	125	9.60	45.50	30
14	7¼	2½	200	16.00	81.00	61
16	7	3	300	18.00	87.00	75
20	8	3½	500	30.00	156.00	131

Capitol Water-Back

USED in square sectional boilers for heating water for domestic purposes.

Arranged with proper openings for flow and return pipes. Made of cast iron.

Tapped ¾-inch for flow and return, measuring 1½ inches on centers. Also tapped ½-inch for drain.

Width, 3¾ inches; length, 14 inches; capacity, 40 gallons.

List Price (Shipping weight 12 lbs.) $10.00

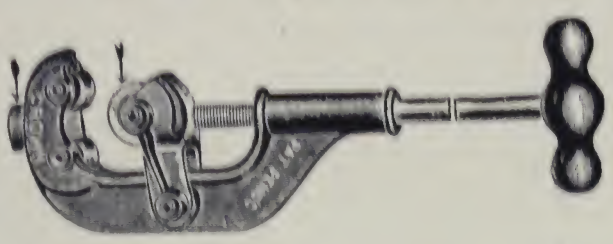
Steel Tool Chests

MADE from $\frac{1}{16}$-inch cold rolled steel with malleable iron corner pieces and hardwood braces; fitted with heavy wrought iron hinges and hasps. Each steel chest is furnished with a first-class lock and two keys and bolts to screw down cover at front corners. Chests under 42″ long have handles on each end only.

Number	Depth Inches	Width Inches	Length Inches	Description	Weight Pounds	List
711	11	12	24	One drawer	60	$18.50
712	14	15	30	One drawer	95	25.00
713	16	17	36	One drawer	125	28.00
714	19	20	42	One drawer	155	32.00
721	11	12	24	Two drawers	65	21.00
722	14	15	30	Two drawers	100	27.00
723	16	17	36	Two drawers	130	29.50
724	19	20	42	Two drawers	160	33.00
701	11	12	30	Without drawer	70	18.50
702	11	12	36	Without drawer	105	22.00
703	11	12	42	Without drawer	140	25.00
704	11	12	48	Without drawer	180	29.00

Special sizes and special constructions made to order.

Crown Pipe Cutters



THESE pipe cutters are equipped with patented notched edge wheel, which saves one-half the time and labor in cutting. All wearing parts are well supported, the wheels and pins are made of the best tool steel. Numbers 2 and 3 cutters have a tapped hole in bottom of frame, which allows operator to screw in a piece of pipe to be used as an extra handle if desired.

Numbers	1	*2	*3
Cut pipe, inches	⅛ to 1	½ to 2	2½ to 4
List each	$4.00	$6.00	$14.00

*If Cutters Nos. 2 and 3 are desired with 3 Cutting Wheels add $1.00 to list price

Capitol Spud Wrenches

No. 1

WITH this wrench, connections for radiator valves and elbows can be quickly made tight, without danger of injuring the union.

No. 1 arranged to fit unions on ¾-inch, 1-inch, 1¼-inch and 1½-inch sizes. Price each, list.....$1.00

No. 2 is a special wrench made of semi-steel. Capacity ½" to 2". Price each, list $2.00

Adjustable Feet

CONSIST of two iron blocks that open by turning the top piece which is so cast that any radiator foot will fit securely. Adjustment can be made with the screw, which holds the two pieces in place. They can be used on any kind of fixture that must stand level. Furnished in plain iron and can be bronzed to correspond to fixture upon them.

No. 1 extends 7/8 to 1¼ inches, list price each.....$0.20
No. 2 extends 1¼ to 1¾ inches, list price each..... .25
No. 3 extends 1⅜ to 2¼ inches, list price each..... .30

Capitol Radiator Wrenches

Direct Radiator Wrench

MADE to fit all United States Wall Radiator screw nipples, which have two lugs on inside so that flattened end of wrench can be applied and the nipple unscrewed or tightened. Price each, $3.50.

Indirect Radiator Wrench

Made especially for assembling Radiators connected with R. & L. Hand Nipples, having hexagon nut in center.

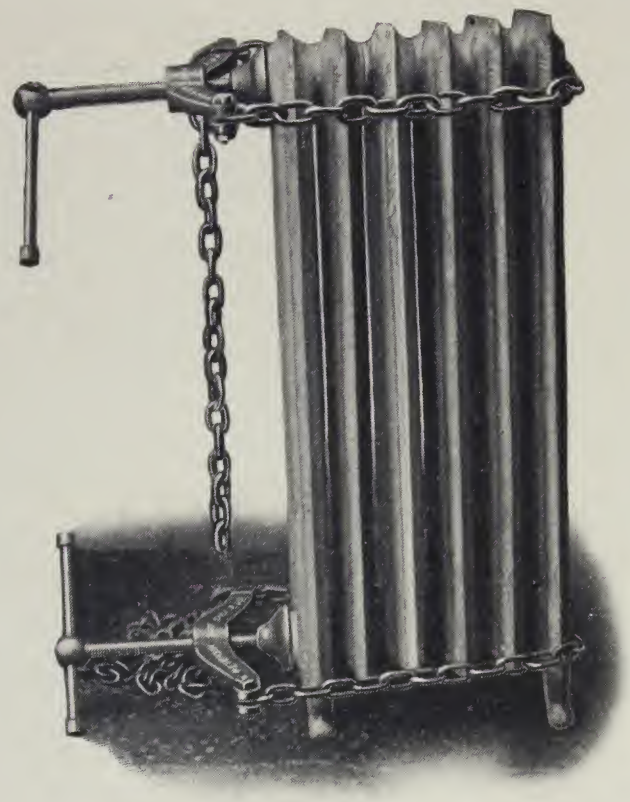
Rod Wrench

For 1½ inch Nipple, list price.....$3.50
For 2 inch Nipple, list price..... 3.50

T handle socket wrench ⅜-inch Hexagon. For tightening the nuts on assembled radiators.

List price, each.....$2.50

Peterson Chain Vise and Pulling Jack



THE Peterson Chain Vise and Pulling Jack—an efficient and durable Vise for assembling Radiators and Boilers having push nipple connections. Cut shows the No. 1 Vise, the size recommended for Steamfitters and Plumbers.

The cross bars or arches are made of malleable iron.

No. 1 with 11 ft. of ⅜ in. chain, list price . . Each, $10.00

(Distance between chains, 14 inches)

No. 2 with 25 ft. of ⅝ in. chain, list price . . . Each, $35.00

(Distance between chains, 20 inches)

Asbestos Plastic Cement

For Boilers, Furnaces, Heaters, Tanks, Etc.

THIS cement is equal to any other on the market. It is white and of lighter weight than ordinary asbestos cement felting, and is consequently a most perfect non-conductor of heat. The material is pure asbestos fibre, mixed with other high-grade fireproof insulating ingredients. It should be mixed to the consistency of ordinary mortar at least twenty-four hours before using. If properly applied, 150 pounds should cover 40 square feet of surface to the depth of one inch. The cement is put up in 50 and 100-pound bags.

Price, per 100 pounds..... $3.50

See page 41 for amounts required to cover Capitol Boilers.

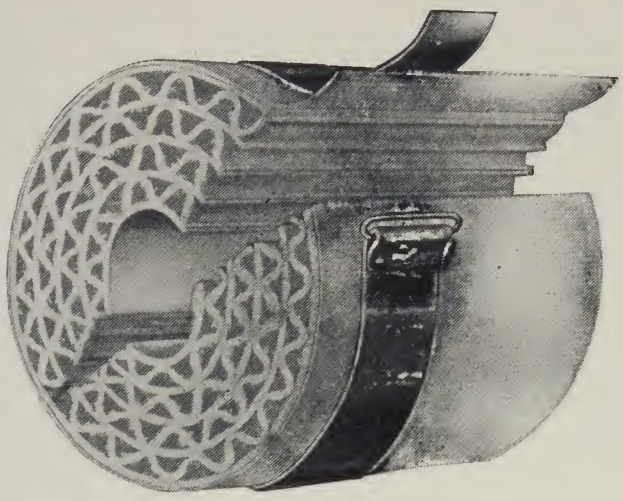
Asbestos Boiler Putty

ESPECIALLY adapted for sealing openings in stoves and cast-iron boilers and as a protection for surfaces exposed to a direct fire.

Will not shrink or become porous.

5-lb. cans, per lb. list...	$0.20	25-lb. cans, per lb. list.....	$0.15
10-lb. cans, per lb. list...	.18	50-lb. cans, per lb. list.....	.12

Capitol Sectional Coverings



Air Cell

FOR high or low pressure steam and hot water pipes our special Asbestos Air-Cell Pipe Covering is absolutely dependable.

It is a perfect insulator, light in weight, yet as strong and durable as any situation could demand. It will not disintegrate from the action of heat, however extreme, and complete satisfaction is guaranteed.

Made in 3-foot lengths; ½, ¾ and 1-inch thickness.

Wool Felt

This covering is composed of a special wool felt, an interlining of pure asbestos felt, heavy canvas outside and finished with brass lacquered metal bands.

Not only is this covering a highly efficient insulating material, but it presents a handsome appearance, very suitable especially for covering pipes exposed to view.

Made in 3-foot lengths; ½, ¾ and 1-inch thickness.

List Prices

Inside Diameter of Pipe, Inches	½	¾	1	1¼	1½	2	2½	3	3½	4
Price per Lineal Foot	$0.22	$0.24	$0.27	$0.30	$0.33	$0.36	$0.40	$0.45	$0.50	$0.60
Inside Diameter of Pipe, Inches	4½	5	6	7	8	9	10	12		
Price per Lineal Foot	$0.65	$0.70	$0.80	$1.00	$1.10	$1.20	$1.30	$1.85		

Old Dan Boiler Compound

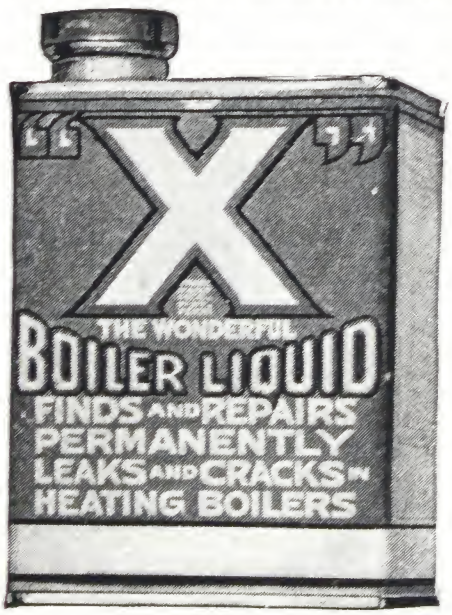
A VEGETABLE compound adapted to the cleansing of all types of boilers.

It will dissolve scale and is of special value in preventing foaming and priming due to oil accumulation.

Use 1 gallon for each 500 sq. ft. of rated steam capacity.

List Prices

5 Gallon Cans. List price $10.00
Half barrels—approximately 25 gals. List price 40.00
Barrels—approximately 50 gals. List price 75.00



"X" the Wonderful Liquid

FINDS and repairs permanently leaks and cracks in steam and hot water boilers.

"X" will not clog air valves, will not affect the evaporating of the water, will produce no odors, and will not interfere with the proper working of the system.

Quantities to Use

	Steam	Hot Water
For boilers having up to 6 sq. ft. of grate	1 quart	1½ quarts
For boilers from 6½ to 12 sq. ft. of grate	2 quarts	3 quarts
For boilers from 12½ to 18 sq. ft. of grate	3 quarts	4 quarts

For larger boilers add 1 quart for every 4 sq. ft. of grate.

List Prices

1 quart can. List price ..... $ 6.00
2 quart can. List price 10.00

Special booklet giving instructions and details on application.

Boiler Repairs

Index

TO assist us in giving prompt service we request that the following detailed information be sent with all repair orders:

1. Name and description of part wanted.
2. Boiler—round or square.
3. Pattern number cast on part.
4. Size number and factory or serial number of boiler, both of which will be found either cast on the front or on brass plate screwed on front.
5. Date of original purchase.
6. Name of dealer of whom original purchase was made.
7. If impossible to give above information a sketch with dimensions marked on same should accompany order.
8. The following information will also be of assistance in making shipment.

If a square boiler, what is width of boiler section across widest part at front? What is total height from bottom of boiler base to top of supply tapping? How many grate bars in boiler? What is the length of grate bars? Are grate bars connected by a bolt and nut or by hook cast in bar?

If a round boiler, how many grate bars in set? What is extreme length of center grate bar? Are grate bars connected by a bolt and nut or by hook cast in bar? If boiler has triangular grate bars, are they hung in a separate ring on base or by small, loose hangers? Does the grate have a center rest underneath?

When ordering repair parts send orders to our nearest Branch Office.

BRANCH OFFICES:

New York, Buffalo, Boston, Cleveland
Philadelphia, Minneapolis, Pittsburgh, St. Louis
Kansas City, Omaha, Chicago, Detroit
Indianapolis, Seattle

Capitol Winchester

NAME OF PARTS	SERIES NUMBER					
	1100 2100 3100 4100	1200 2200 3200 4200	1300 2300 3300 4300	1400 2400 3400 4400	1500 2500 3500 4500	1600 2600 3600 4600
Base, O. S. or N. S.	$20.50	$20.50	$24.00	$32.75	$44.00	$55.75
Base Plate Front, O. S. or N. S.	3.40	3.75	3.90	5.75	7.00	8.40
Base Plate Front, Pres. Style	3.40	3.75	3.90	5.75	7.00	8.40
Ash Pit Door, Pres. Style	3.75	4.50	6.40	6.95	7.80	7.90
Ash Pit Door, O. S. or N. S.	3.00	4.50	6.40	6.95	7.80	7.90
Clinker Door for Triangular Grate	1.95	2.00	2.45	2.65	3.20	3.30
Clinker Door for Rotary Grate, O. S. or N. S.	1.10	1.70	2.30	2.65	3.40	.....
Clinker Door for Flat Top Rocking Grate	.75	.90	1.10	1.10	1.10	1.10
Clinker Door Frame for Flat Top Rocking Grate	1.30	1.40	1.90	3.05	2.65	2.65
Clinker Door Lining for Flat Top Rocking Grate	.40	.50	.50	.75	.75	.75
Shaker Door, Rotary Grate	.50	.50	.50	.50	.50	.....
Ash Pit Door Hinge Pin	.30	.30	.30	.30	.30	.30
Draft Door	.55	.55	.75	.90	1.10	1.50
Draft Door Frame	.75	.75	.75	.85	1.10	1.10
Draft Door Ratchet	.30	.30	.30	.30	.30	.30
Rotary Grate Ring	3.50	4.75	7.75	10.50	15.00	.....
Rotary Grate Bar (Short)	2.70	2.80	2.95	3.75	6.00	.....
Rotary Grate Bar (Long)	2.85	2.85	3.30	4.35	6.45	.....
Rotary Grate Link	.40	.50	.50	.50	.75	.....
Rotary Grate Frame	3.00	4.40	4.75	6.50	7.75	.....
Rotary Grate Frame Cap	.30	.30	.30	.30	.30	.....
Rotary Grate Yoke, O. S.	.50	.50	.50	.50	.....	.....
Ball Bearings, per set (three)	.50	.50	.50	.50	.....	.....
Grate Ring Shaker Handle	.75	.75	1.00	1.00	1.00	.....
Grate Ring Shaker Handle (Vertical)	2.50	2.50	2.50	2.50	2.50	.....
Dumping Handle	1.15	1.15	1.15	1.15	1.15	.....
Combination Shaker Handle, O. S.	1.00	1.00	1.00	1.00	1.00	1.00
Rocking Grate Bars (Short)	1.50	2.10	2.10	2.60	3.15	4.10
Rocking Grate Bars (Intermediate)	.....	.....	2.75	3.95	4.65	5.45
Rocking Grate Bars (Long Center)	2.05	2.70	.....	.....	4.65	6.05
Shaker Catch	.30	.30	.30	.30	.30	.30
Grate Lugs for Rocking Grates	.50	.65	.65	.65	.65	.65
Connecting Rod Shaking Grates	.50	.50	.60	.60	.60	.60
Connecting Rod Joining Bars	.50	.50	.60	.60	.60	.60
Grate Frame	6.00	6.90	8.60	10.40	13.25	16.25
Eye Winker Rotary Grate, Pres. Style	.30	.30	.30	.30	.30	.30
Connecting Rods, Rotary Grate, Pres. Style	.75	.75	.75	.75	.75	.....
Hook Bolts, pair, Pres. Style	.30	.30	.30	.30	.30	.....
Rotary Grate, complete	9.50	10.80	12.90	16.20	23.80	.....
Rotary Grate, complete, Pres. Style	17.50	18.70	20.80	25.10	33.90	.....
Base, complete with Rotary Grate	50.50	52.40	60.30	79.00	99.60	.....
Base, complete, Rotary Grate, Pres. Style	49.20	51.40	57.20	76.90	97.70	.....

When ordering refer to page 125.

Capitol Winchester—Continued

NAME OF PARTS	SERIES NUMBER					
	1100 2100 3100 4100	1200 2200 3200 4200	1300 2300 3300 4300	1400 2400 3400 4400	1500 2500 3500 4500	1600 2600 3600 4600
Triangular Grate Bar	$1.45	$1.50	$1.75	$1.95	$2.35	$4.25
Triangular Grate Frame	6.75	8.25	9.75	14.50	16.10	25.10
Triangular Grate Cap	.30	.30	.30	.30	.30	.30
Triangular Grate Gear	.50	.50	.50	.50	.50	.90
Eye Winker for Triangular Grate	.30	.30	.30	.30	.30	.30
Shaker Handle for Tri. Grate	1.00	1.00	1.00	1.25	1.40	1.40
Triangular Grate, complete	16.20	16.60	22.00	30.80	39.00	51.00
Base, com. with Tri. Grate	49.70	50.70	59.70	83.60	104.80	126.30
Fire Pot	50.25	58.25	68.50	83.00	96.00	109.50
Fire Door, Flat, O. S	1.50	1.50	1.90	2.25	2.25	.....
Fire Door Frame, Flat, O. S	2.25	2.65	3.75	3.75	3.75	.....
Fire Door, Curved	2.25	2.45	3.20	3.20	3.40	3.75
Fire Door Frame, Curved	3.00	3.20	3.75	4.15	4.90	5.80
Fire Door Lining, Flat, O. S	.75	1.10	1.50	1.50	1.50	2.05
Fire Door Lining, Curved	.95	1.10	1.90	1.50	1.65	2.05
Fire Door Slide, Straight	.40	.40	.40	.40	.40	.40
Fire Door Handle	.40	.40	.40	.40	.40	.40
Coal Guard	1.00	1.00	1.25	1.40	1.65	1.90
Fire Door Slide, Curved	.40	.40	.40	.40	.40	.50
Center Flue Intermediate Ring	10.50	12.75	15.75	22.00	27.00	35.75
Outer Flue Intermediate Ring	10.50	13.00	16.75	24.25	27.75	38.00
Cleanout Door, Flat, O. S	.40	.75	.75	.75	1.10	.....
Cleanout Door, Curved	1.30	1.30	1.30	1.30	1.30	1.30
Cleanout Door Frame, O. S	1.10	1.10	1.50	1.50	1.90	.....
Cleanout Door Frame, Curved	1.30	1.30	1.90	1.90	2.25	2.35
Cleanout Door Frame on Dome, Curved	1.30	1.30	1.90	2.50	2.70	3.00
Dome, Steam	20.75	24.25	31.50	42.50	49.25	64.75
Dome, Water	10.50	12.50	16.25	21.75	27.25	35.25
Smoke Ell, R. H. (Half)	2.05	2.45	2.45	3.40	3.75	4.50
Smoke Ell, L. H. (Half)	2.05	2.45	2.45	3.40	3.75	4.50
Smoke Ell Clips	.30	.30	.30	.30	.30	.30
Smoke Ell, complete	7.00	7.00	7.20	9.60	11.80	13.60
Smoke Ell Check Door	.50	.75	.75	.75	1.10	1.50
Check Door Ratchet	.30	.30	.30	.30	.30	.30
Damper	.30	.50	.75	.75	.75	.75
Damper Handle	.30	.30	.30	.30	.30	.30
Damper Handle Ratchet	.30	.30	.30	.30	.30	.30
Water Column	3.00	3.00	3.00	3.00	3.00	3.00
Water Column Pipe Connections	2.00	2.00	2.00	2.00	2.00	2.00
Diaphragm, complete (Metal)	6.35	6.35	6.35	6.35	6.35	6.35
Diaphragm only (Metal)	4.00	4.00	4.00	4.00	4.00	4.00
Diaphragm, O. S	3.00	3.00	3.00	3.00	3.00	3.00
Diaphragm Lever	.30	.30	.30	.30	.30	.30
Diaphragm Plunger	.30	.30	.30	.30	.30	.30
Diaphragm Weight	.30	.30	.30	.30	.30	.30
Diaphragm Rubber	1.25	1.25	1.25	1.25	1.25	1.25
Diaphragm, complete	5.35	5.35	5.35	5.35	5.35	5.35
Steam Trimmings, complete	12.50	12.50	12.50	12.50	12.50	12.50
Push Nipple	.75	.75	1.00	1.00	1.65	1.65
Number Plate	.30	.30	.30	.30	.30	.30
Section Connecting Bolt	.40	.40	.40	.40	.50	.50
Hoe	.80	.80	.80	.80	1.00	1.00
Poker	1.00	1.00	1.00	1.00	1.00	1.00

When ordering refer to page 125.

Capitol Winchester—Continued

NAME OF PARTS	SERIES NUMBER					
	1100 2100 3100 4100	1200 2200 3200 4200	1300 2300 3300 4300	1400 2400 3400 4400	1500 2500 3500 4500	1600 2600 3600 4600
Flue Scraper	$0.50	$0.50	$0.50	$0.50	$0.50	$0.50
Number of Bars for Triangular Grate	Three	Three	Five	Five	Six	Five
Draw Rods (Each)	.40	.40	.50	.50	.60	.60
Coil Cover	.30	.30	.30	.30	.30	.30

Commencing about Serial Number 13600 Capitol Winchesters were shipped with Clinker Door in fire pot, and standard grate bars for the 33″ Boiler were changed from Triangular to Flat Top Rocking Type.

When ordering refer to page 125.

Sunray Square Sectional

50E, 90A, 320, 230, and WN270 Series

NAME OF PARTS	SERIES NUMBER				
	50E	90A	320	230	WN 270
Front Section	$52.00	$66.80	$107.40	$109.40	.....
Plain Middle Section	36.60	53.40	88.00	103.40	.....
Plain Middle Section, Tapped	38.80	50.80	90.60	106.40	.....
Middle Next Back	40.20	.....	.....	101.40	.....
Next Back Section, Tapped	41.60	.....	.....	102.80	.....
Bridge Wall Section	.....	.....	104.60	.....	.....
Bridge Wall Plate, R. or L.	.....	.....	.....	.....	$22.25
Back Section	52.60	71.00	102.20	123.80	.....
Front Section, R. or L.	.....	.....	.....	.....	89.40
Plain Middle Section, R. or L.	.....	.....	.....	.....	96.20
Plain Middle Section, Tapped, R. or L.	.....	.....	.....	.....	100.00
Middle Next Back Sec., Tapped, L.H.	.....	.....	.....	.....	97.40
Middle Next Back Section, Plain, R. or L.	.....	.....	.....	.....	94.20
Middle Section, Tapped ¾″	.....	.....	.....	.....	96.20
Back Section, R. or L.	.....	.....	.....	.....	111.40
Closing Strip	.....	.....	.....	.....	1.65
Ashpit Door	4.60	4.60	6.25	4.35	6.40
Ashpit Flap Door	.50	.50	1.25	1.50	1.40
Ashpit Door Slide	.40	.40	.50	.50	.45
Ashpit Door Handle	.30	.30	.30	.30	.50
Ashpit Door Catch	No Chg.	No Chg.	No Chg.	No Chg.	No Chg.
Base Front	3.90	5.70	6.75	9.30	21.00
Base Front Ratchet	.....	.....	.....	.30	.....
Base Back, Old Style	4.55	5.90	10.75	6.90	16.50
Base Back Covering Plate, Old Style	.65	.70	.70	.70	2.15
Base Back Plate Catch	.30	.30	.30	No Chg.	.30
Back Corrugated Plate	.....	.....	8.10	.....	.....
Back Plain Plate	.....	.....	11.20	.....	.....
Top Back Base Plate	.....	.....	.....	3.70	.....
Bottom Back Base Plate	.....	.....	.....	4.20	.....
Base Side, 1 Extension	.....	.....	2.10	2.25	5.00
Base Side, 2 Extension	.....	3.00	3.30	4.95	10.40
Base Side, 3 Extension	.....	.....	.....	7.40	13.80

When ordering refer to page 125.

Sunray Square Sectional—Continued

50E, 90A, 320, 230, and WN270 Series

NAME OF PARTS	SERIES NUMBER				
	50E	90A	320	230	WN 270
Base Side, 4 Extension	$6.00	$6.40	.....	$10.90	$18.80
Base Side, 5 Extension	7.50	6.70	.....	.....	19.25
Base Side, 6 Extension	9.00	8.95	$8.85	.....	.....
Base Side, 7 Extension	10.50	9.80	10.35	19.40	.....
Base Side, 8 Extension	12.00	13.10	11.90	.....	.....
Base Side, 9 Extension	14.60	14.25	13.70	.....	.....
Base Side, 10 Extension	.....	.....	15.90	.....	.....
Base Side with Draft Opening, 4 Section	5.70	.....	.....	10.00	.....
Base Side with Draft Opening, 5 Sec.	7.90	.....	.....	.....	16.50
Base Side with Draft Opening, 6 Sec.	8.70	.....	.....	.....	.....
Base Side with Draft Opening, 7 Sec.	10.90	.....	.....	18.00	.....
Base Side with Draft Opening, 8 Sec.	12.00	.....	.....	.....	.....
Base Side with Draft Opening, 9 Sec.	14.30	.....	.....	.....	.....
Base Side Draft Door	.65	.....	.....	1.25	1.75
Base Side Draft Door Frame	1.40	.....	.....	2.00	5.40
Grate, Middle, Coarse	1.80	4.45	6.00	5.75	11.90
Grate, Middle, Small Mesh	.....	.....	.....	4.95	11.50
Grate, One-Half Stationary	1.05	2.75	3.60	2.50	4.35
Grate Rest, per Section	.....	.30	.50	.....	.....
Grate Lock	.....	.....	.....	.....	.50
Short Connecting Bar, Old Style	.70	.50	.50	.50	1.30
Long Connecting Bar, per Grate, Old Style	.20	.30	.30	.30	.30
Front Short Connecting Bar, Old Style	.55	.....	.60	.50	.....
Connecting Bar Bracket, Old Stlye	.....	.....	.....	.50	.....
R. H. Con. Bar 1—Grate N. S.	.....	.....	.....	1.75	.....
R. H. Con. Bar 2—Grate N. S.	.....	.....	.....	2.80	.....
R. H. Con. Bar 3—Grate N. S.	.....	.....	.....	3.85	.....
R. H. Con. Bar 1—Grate	.....	.....	.....	.96	.....
R. H. Con. Bar 2—Grate	.....	.....	.....	1.40	.....
R. H. Con. Bar 2—Grate (Spec.)	.....	.....	.....	1.13	.....
L. H. Con. Bar 3—Grate	.....	.....	.....	2.30	.....
L. H. Con. Bar 4—Grate	.....	.....	.....	3.00	.....
Shaker Arm	.90	.90	.85	1.95	3.25
Shaker Fulcrum	.30	.30	.30	.90	1.40
Shaker Handle	1.50	1.40	1.40	1.00	1.00
Shaker Link	.....	.....	.....	.50	.....
Shaker Catch, Front Half	.....	.....	.....	.30	.....
Shaker Catch, Back Half	.....	.....	.....	.30	.....
Fire Door	2.95	5.25	5.25	4.90	.....
Fire Door Frame	5.70	5.25	5.25	.....	.....
Fire Door, R. or L.	.....	.....	.....	.....	4.50
Fire Door Liner, R. or L.	.....	.....	.....	.....	2.25
Fire Door Liner	1.95	1.70	1.70	1.75	.....
Fire Door Wheel	.30	.30	.30	.30	.30
Fire Door Catch	.....	.....	.....	.50	.30
Fire Door Handle	.30	.30	.30	.50	.50
Fire Door Hinge Plate	.....	.....	.....	1.00	1.00
Clinker Door, R. or L.	.....	.....	.....	2.00	1.00
Clinker Door Liner, R. or L.	.....	.....	.....	1.25	1.00
Clinker Door Handle	.....	.....	.....	.50	.30
Clinker Door Catch	.....	.....	.....	.30	.....
Cleanout Door	6.00	5.50	.....	4.25	.....
Cleanout Door Frame	4.90	6.60	.....	.....	.....
Cleanout Door Liner	3.00	2.50	2.50	.....	.....

When ordering refer to page 125.

Sunray Square Sectional—Continued

50E, 90A, 320, 230, and WN270 Series

NAME OF PARTS	SERIES NUMBER				
	50E	90A	320	230	WN 270
Cleanout Door, Large R. or L.	.....	.....	$5.00	.....	$10.90
Cleanout Door, Small R. or L.	.....	.....	.....	.....	3.25
Cleanout Door Liner, Small R. or L.	.....	.....	.....	.....	1.40
Cleanout Door Hinge Plate, Large	.....	.....	.....	.....	1.40
Cleanout Door Hinge Plate, Small	.....	.....	.....	.....	.90
Cleanout Door Handle	$0.30	$0.30	.30	$0.50	.50
Cleanout Door Catch	.....	.30	.30	.30	.30
Hinge Pin	No Chg.	No Chg.	No Chg.	No Chg.	No Chg.
Baffle Plate Front	.....	.....	.....	.....	1.65
Baffle Plate, R.H. or L.H., O. S.	.....	.30	.....	.....	.....
Rear Opening Smoke Box Blank (Closed Half)	4.50	6.50	.....	6.20	17.00
Rear Opening Smoke Box with Check Opening	4.30	6.30	18.00	5.50	13.80
Top Opening Smoke Hood, Right Half, with Check Door Opening	.....	.....	.....	5.50	28.25
Top Opening Smoke Hood, Left Half, Blank Side	.....	.....	.....	6.25	31.50
Smoke Box Check Frame	.....	.....	1.75	1.15	.....
Smoke Box Check Draft Door	.....	.....	.....	.....	1.15
Smoke Box Lid	.50	.65	.65	.50	1.65
Smoke Box Damper	1.05	1.50	3.00	3.05	6.25
Smoke Box Damper Connection	.30	.30	.30	.50	.....
Smoke Box Damper Handle	.....	.30	.30	.....	.....
Smoke Box Damper Arm	.....	.....	.....	.30	.30
Smoke Box Damper Angle Lever	.....	.....	.....	.50	.....
Smoke Box Damper Operating Rear Standard	.....	.....	.....	.50	.....
Smoke Box Damper Operating Front Standard	.....	.....	.....	.50	.....
Smoke Box Damper Operating Handle	.....	.....	.....	.40	.....
Smoke Box Damper Operating Connecting Rod	.....	.....	.....	.20	.....
Smoke Box Cap	.....	3.60	.....	3.40	.....
Smoke Box Collar 10" or 12"	.....	2.40	.....	.....	.....
Smoke Box Segment Gauge Fulcrum	.30	.30	.50	.....	.....
Smoke Box Segment Gauge	.30	.30	.50	.....	.50
Smoke Box Segment Gauge Catch	.30	.30	.50	.....	.30
Smoke Hood Complete (Back Outlet)	12.00	22.45	25.50	22.55	39.25
Smoke Hood Complete (Top Outlet)	.....	.....	.....	22.55	68.00
Indirect Damper	1.50	2.25	2.45	.....	.....
Water Column	.....	.....	.....	4.00	4.00
Water Column Connection	.....	.....	.....	3.00	3.00
Diaphragm Metal Comp	.....	.....	.....	6.55	6.55
Diaphragm Only, Metal	.....	.....	.....	4.00	4.00
Diaphragm Only, O. S.	3.00	3.00	3.00	3.00	3.00
Diaphragm Plunger	.30	.30	.30	.30	.30
Diaphragm Lever	.30	.30	.30	.30	.30
Diaphragm Lever Link	.....	.....	.....	.30	.30
Diaphragm Weight, Large	.....	.....	.50	.50	.50
Diaphragm Weight, Small	.40	.40	.40	.40	.40
Diaphragm Connecting Pipe	.30	.30	.30	.50	.50
Diaphragm Rubber	1.25	1.25	1.25	1.25	1.25
Diaphragm Complete, Old Style	5.55	5.55	5.65	6.35	6.35
Steam Trimmings Complete	10.00	10.00	12.00	12.00	14.00
Number Plate	No Chg.	No Chg.	No Chg.	No Chg.	No Chg.

When ordering refer to page 125.

Sunray Square Sectional—Continued

50E, 90A, 320, 230, and WN270 Series

NAME OF PARTS	SERIES NUMBER				
	50E	90A	320	230	WN 270
Name Plate	$0.30	$0.30	$0.30	$1.00	$2.00
Nipple 4"—C. I.	.....	.....	.....	.75	.75
Nipple 5¼"—C. I.	.....	.....	.....	1.00	1.00
Nipple 3"—Steel	.40	.40	.40	.....	.....
Nipple 4"—Steel	.....	.....	.40	.....	.....
Washer, Small, per ½ doz	.30	.30	.30	.30	.30
Washer, Large	.30	.30	.30	.30	.30
Thumb Screw	.30	.30	.30	.30	.30
Thumb Latch	.30	.30	.30	.30	.30
Set 4 Tie Rods, 4 Sections	1.40	.....	.....	.....	.....
Set 4 Tie Rods, 5 Sections	1.80	2.00	.....	2.40	.....
Set 4 Tie Rods, 6 Sections	2.00	2.20	2.40	2.80	4.00
Set 4 Tie Rods, 7 Sections	2.40	2.60	2.60	3.20	4.50
Set 4 Tie Rods, 8 Sections	.....	2.80	2.80	3.60	5.00
Set 4 Tie Rods, 9 Sections	.....	3.20	3.20	4.00	5.80
Set 4 Tie Rods, 10 Sections	.....	.....	.....	4.40	6.40
Set 4 Tie Rods, 11 Sections	.....	.....	.....	.....	7.00
Set 4 Tie Rods, 12 Sections	.....	.....	.....	.....	7.60
Set 4 Tie Rods, 13 Sections	.....	.....	.....	.....	8.20
Set 4 Tie Rods, 14 Sections	.....	.....	.....	.....	8.80
Hoe	.75	.75	.75	1.25	1.50
Poker	.75	.75	.75	1.50	1.75
Flue Brush	.80	.80	.80	1.10	1.30
Flue Brush Handle	.50	.50	.50	.75	.75
Slice Bar	.....	.....	.....	.....	5.00
Draw Clamp, Upper	.....	.....	.....	1.50	1.50
Draw Clamp, Lower	.....	.....	.....	1.00	1.00
Coil Plate	.....	.....	.....	.30	.....
Scraper Blade	.....	.....	.....	1.00	.....

The 50E Series has three connecting rods in set.

The 50E Series has one less middle grate bar than number of sections and a front and rear half bar.

The 90A and 320 Series have two less intermediate grate bars than number of sections and a front and rear half bar. The 230 and WN270 Series have one less intermediate grate bar than number of sections and a front half bar. Commencing with Serial 46000 New Base was supplied on 230 Series Boilers, which entailed the use of a divided rear Base Plate.

NOTE.—20-inch grate.

50A, 50B and 550 Series Sunray same as 50E Series except grates and Shaker attachments. 500 and 530 Series same as above except having plate front and back. 20 Series Sun same as 50E Series Sunray.

24-inch grate.

70 Series Sunray (without 1904) same as 90A Series except having plate front and back. 70 Series (with 1904) same, with water front and back. C. O. doors same but fire door larger on plate front.

90 and 90A Series are the same except latter has double shake over six sections.

24 and 24-B Series Sun same as 90 and 90A Series Sunray.

32-inch grate.

80 Series Sunray (without 1904) same as 320 Series except having plate front and back. 80 Series (with 1904) same, with water front and back. C. O. doors same but fire door larger on plate front. 800 Series same as 80 Series dated 1904, also same as 320 Series except slight difference in intermediate section, although interchangeable.

32B Series Sun same as 800 Series Sunray.

32 Series Sun same as 320 Series Sunray.

Letters found with size numbers of Sunray Boilers indicate some change and should always be given when ordering repairs.

When ordering, refer to page 125.

Furman Square Sectional

NAME OF PARTS	SERIES NUMBER				
	180	220	G270 270	330	380
Front Section	$39.20	$51.80	$75.00	$97.40	$161.40
Reg. Intermediate Section	40.40	56.60	76.60	85.20	155.60
Special Tapped Section next front	38.00	54.40	74.80	88.00	142.80
Special No-Tap Section	.....	.....	.....	.....	142.80
Reg. Intermediate Section, Tapped	40.80	56.00	75.80	87.20	156.40
Back Section	45.00	59.60	89.40	99.20	179.80
Front Base Plate	2.55	3.45	4.80	5.85	10.65
Front Base Plate, N. S.	.....	.....	.....	5.85	.....
Side Base Plate with Draft Opening	.....	.....	.....	.....	10.60
Side Base Plate (1 grate)	1.20	1.20	1.80	1.85	3.00
Side Base Plate (2 grate)	3.45	3.45	4.80	5.10	6.15
Side Base Plate (3 grate)	3.75	.....	5.10	6.90	8.70
Side Base Plate (4 grate)	5.70	5.70	7.95	9.45	11.70
Corner Base Plates	.....	.....	.....	.....	2.40
Back Base Plate	3.30	4.50	6.00	8.70	8.70
Back Base Plate, covering plate	.....	.....	.....	.....	1.80
Base Plate Cap, open	.30	.30	.30	.30	.50
Base Plate Cap, closed	.....	.....	.30	.30	.50
Connecting Bar Guiders on Bases over 4 Grates	.50	.50	.50	.50	.50
Ash Pit Door	2.00	2.00	2.00	.....	3.50
Ash Pit Door, O. S. or N. S.	.....	.....	.....	2.50	.....
Draft Door (New Style)	.....	.....	.....	1.75	.....
Draft Door	.70	.75	.75	1.75	2.00
Draft Door Ratchet	.30	.30	.30	.30	.30
Draft Door on Base Side	.....	.....	.....	.....	2.50
Grate Bar, Front or Rear Half	.65	1.00	1.35	1.70	3.60
Grate Bar, Intermediate	1.80	2.50	3.15	3.70	10.00
Grate Bar, Intermediate (New Style)	.....	.....	.....	6.00	.....
Base Grate Lug	.30	.30	.30	.30	.....
Base Front Connecting Bar	.60	.90	1.25	1.50	1.60
Connecting Bar (2 grate)	.90	.90	.....	.....	.....
Connecting Bar (3 grate)	1.25	1.25	1.05	.....	.....
Connecting Bar (4 grate)	1.40	1.40	.....	1.75	.....
Connecting Bar (3 grate) N. S.	.....	.....	.....	1.30	1.40
Connecting Bar (4 grate) N. S.	.....	.....	.....	1.50	1.95
Connecting Bar (5 grate) N. S.	.....	.....	.....	2.25	2.45
Connecting Bar, 1 grate (extension)	.40	.50	.55	.50	.....
Connecting Bar, 2 grate (extension)	.80	.80	.80	.80	.....
Connecting Bar, 3 grate (extension)	.....	.....	1.05	1.05	.....
Shaker Handle	.80	1.40	1.60	1.60	3.00
Fire Door	2.25	2.40	2.40	4.00	4.50
Fire Door Lining	1.40	1.50	1.50	2.50	3.50
Fire Door Damper Wheel	.30	.30	.30	.30	.30
Fire Door Hinge Lugs	.....	.....	.40	.65	.....
Fire Door, N. S.	.....	.....	.....	3.50	.....
Fire Door Lining, N. S.	.....	.....	.....	2.40	.....
Fire Door Frame, N. S.	.....	.....	.....	3.00	.....
Clinker Door	1.25	1.25	1.25	1.75	2.00
Clinker Door Lining	.70	.70	.75	.85	1.00
Clinker Door Plate	1.25	1.40	2.00	2.25	2.50
Clinker Door, N. S.	.....	.....	.....	2.50	.....
Clinker Door Lining, N. S.	.....	.....	.....	1.00	.....
Clinker Door Frame, N. S.	.....	.....	.....	2.50	.....
Clinker Door Plate, N. S.	.....	.....	.....	2.50	.....
Clinker Door Hinge Lug	.....	.....	.30	.75	.....
Cleanout Door, R. or L.	1.50	1.65	2.25	2.75	2.90

When ordering refer to page 125.

Furman Square Sectional—Continued

NAME OF PARTS	SERIES NUMBER				
	180	220	G270 270	330	380
Cleanout Door Lining, R. or L.	$0.70	$1.15	$1.15	$1.15	$1.25
Cleanout Door, R. or L., N. S.	.....	.....	.....	2.75	.....
Cleanout Door Lining, R. or L., N. S.	.....	.....	.....	1.00	.....
Cleanout Door Frame, R. or L., N. S.	.....	.....	.....	2.25	2.25
Center Cleanout Door	.....	.....	.....	.....	3.25
Center Cleanout Door Lining	.....	.....	.....	.....	3.25
Center Cleanout Door Frame	.....	.....	.....	.....	3.25
Cleanout Door Lugs	.....	.....	.40	.40	.....
Door Catches	.....	.....	.40	.30	.....
Smoke Ell, Right Hand	3.40	4.00	5.40	7.25	10.75
Smoke Ell, Left Hand	3.75	4.50	6.25	7.75	13.00
Smoke Ell Damper	.90	1.00	1.25	1.75	3.50
Smoke Ell Complete	9.50	11.50	15.00	19.85	36.00
Smoke Ell Check Door	.50	.50	.50	1.25	1.25
Check Door Frame	.50	1.00	1.25	1.25	1.25
Check Door Ratchet	.30	.30	.30	.30	.....
Smoke Box Cap	.....	.....	.....	.....	5.25
Damper Rod	.30	.30	.30	.30	.30
Smoke Box, R. H.	3.75	.....	6.25	.....	.....
Smoke Box, L. H.	3.75	.....	6.00	.....	.....
Smoke Box Complete	9.80	.....	17.30	.....	.....
Smoke Box Damper	1.00	.....	1.30	.....	.....
Damper Rod Lever	.30	.30	.30	.30	.30
Back Damper Rod Clip	.30	.30	.30	.30	.30
Damper Connecting Rod	1.00	1.00	1.00	1.00	1.00
Front Damper Gauge Clip	.30	.30	.30	.30	.30
Damper Adjustment Handle	.30	.30	.30	.30	.30
Damper Handle and Ratchet	.60	.60	.60	.60	.....
Coil Plate	.30	.30	.30	.30	.30
Baffle Plate	.30	.40	.75	.75	.50
Water Bottle	2.00	2.00	2.00	2.00	2.00
Water Bottle Connections	1.60	1.60	1.60	1.60	1.60
Water Column	2.40	2.40	2.40	2.40	2.40
Water Column Connections	3.00	3.00	3.00	3.00	3.00
Diaphragm Metal Complete	6.35	.....	6.35	.....	.....
Diaphragm Metal Only	4.00	.....	4.00	.....	.....
Diaphragm	3.00	3.00	3.00	3.00	3.00
Diaphragm Lever	.30	.30	.30	.50	.50
Diaphragm Weight, Small	.30	.30	.30	.30	.30
Diaphragm Weight, Large	.50	.50	.50	.50	.50
Diaphragm Plunger	.30	.30	.30	.30	.30
Diaphragm Rubber	1.25	1.25	1.25	1.25	1.25
Diaphragm Complete	5.65	5.65	5.65	5.85	5.85
Number Plate	N. C.	N. C.	N. C.	N. C.	N. C.
Steam Trimmings Complete	15.50	15.50	15.50	17.00	19.00
2 Inch Push Nipple	.50	.....	.....	.....	.....
3 Inch Push Nipple	.....	.50	.....	.....	.....
4 Inch Push Nipple	1.00	1.00	1.00	1.00	1.00
6 Inch Push Nipple	.....	.....	1.50	1.50	1.50
4 Inch Draw Clamps, each	1.50	2.00	2.00	2.00	2.00
6 Inch Draw Clamps, each	.....	.....	2.50	2.50	2.50
Set 4 Tie Rods, 4 Sec	1.60	.....	.....	.....	.....
Set 4 Tie Rods, 5 Sec	2.00	2.00	.....	.....	.....
Set 4 Tie Rods, 6 Sec	2.20	2.20	2.60	.....	.....
Set 4 Tie Rods, 7 Sec	2.60	2.60	2.60	2.60	4.50
Set 4 Tie Rods, 8 Sec	.....	3.00	2.80	3.20	5.00
Set 4 Tie Rods, 9 Sec	.....	.....	3.20	3.80	5.80

When ordering refer to page 125.

Furman Square Sectional—Continued

NAME OF PARTS	SERIES NUMBER				
	180	220	G270 270	330	380
Set 4 Tie Rods, 10 Sec	.....	.....	.....	$4.00	$6.40
Set 4 Tie Rods, 11 Sec	.....	.....	.....	.....	7.00
Flue Brush	$0.80	$0.80	$0.80	.80	.80
Flue Brush Handle	.50	.50	.50	.50	.50
Poker	.80	.80	.80	.80	.80
Hoe	.80	.80	.80	.80	.80

All above Series have two less grate bars than number sections and a front and rear half stationary bar.

The entire front section and all parts on front of boilers as well as grates and connecting bars were changed January 1st, 1911, on 330 Series. A change also made from solid door lugs and catches to loose pattern on 270 and 330 Series.

New style Grate Bars commenced with Serial 10356 on 330 Series.

When ordering refer to page 125.

Furman Round Sectional

NAME OF PARTS	SERIES NUMBER				
	16"	19"	22"	25"	29"
Base	$16.25	$18.00	$20.25	$25.50	$38.50
Front Base Plate	.....	3.25	3.90	4.75	.....
Front Base, Upper Half	1.15	.....	.....	.....	2.50
Front Base, Lower Half	1.25	.....	.....	.....	5.00
Ash Pit Door	3.00	3.75	3.75	3.75	3.75
Draft Door	.95	1.15	1.15	1.15	1.15
Draft Door Ratchet	.30	.30	.30	.30	.30
Grate Bar Short, R. or L., O. or N. S.	.90	1.15	1.30	1.30	1.50
Grate Bar Short, Pres. S	.....	1.50	2.35	2.35	2.55
Grate Bar Medium, R. or L., O. S. or N. S	.....	.....	.....	1.65	2.20
Grate Bar Medium, Pres. S	.....	.....	.....	2.55	3.15
Grate Bar Long, R. or L., O. S. or N. S.	1.45	1.90	1.95	1.95	2.85
Grate Bar Long, Pres. S	.....	2.15	2.70	2.70	3.30
Grate Bar Gear, O. S., N. S. or Pres. S.	.30	.30	.30	.30	.30
Grate Base Lug	.30	.....	.....	.....	.....
Grate Center Rest, Pres. S	.....	.....	.....	2.00	2.40
Grate Center Lugs, Pres. S	.....	.....	.....	.30	.30
Grate Center Rest Hanger	.....	.....	.....	.30	.30
Grate Bar Washer, O. S. or N. S	.30	.30	.30	.30	.50
Grate Ring, O. S. or N. S	4.75	5.25	6.75	6.75	10.00
Grate Ring, Pres. S	.....	5.25	6.75	7.75	9.50
Grate Bar Hanger, O. S. or N. S	.30	.30	.30	.30	.50
Back Hanger, Pres. S	.....	1.40	1.50	2.40	2.60
Gear Rack, Pres. S	.....	1.75	2.00	2.00	2.75
Gear Rack Lugs, Pres. S	.....	1.00	1.00	1.00	1.00
Grate Shaker Handle, O. S. or N. S. or Pres. S	.90	.90	.90	.90	.90
Fire Pot	76.00	107.00	134.00	159.00	189.00
Clinker Door	.95	1.10	1.10	1.10	1.10
Clinker Door Frame	1.80	1.90	1.90	1.90	1.90
Clinker Door Lining	.50	.75	.75	.75	.75
Fire Door	1.70	2.25	3.00	3.00	3.00
Fire Door Frame	3.00	3.75	3.75	3.75	3.75
Fire Door Lining	1.00	1.00	1.50	1.90	1.90
Fire Door Wheel	.30	.30	.30	.30	.30
Intermediate Ring B	20.80	24.00	28.00	38.00	47.00
Intermediate Ring C	19.20	25.25	29.20	33.50	54.00
No Ring C. O. Door, O. S	.75	.75	.75	.75	.75
No Ring C. O. Door Frame, O. S	1.30	1.30	1.50	1.50	1.50
One Ring C. O. Door, O. S	1.90	1.90	1.90	1.90	1.90
One Ring C. O. Door Frame, O. S	2.25	2.25	2.25	2.25	2.60
Two Ring C. O. Door, O. S	2.60	3.00	3.00	3.00	3.00
Two Ring C. O. Door Frame, O. S	2.80	2.80	3.00	3.00	3.00
Three Ring C. O. Door, O. S	.....	.....	.....	.....	3.40
Three Ring C. O. Door Frame, O. S	.....	.....	.....	.....	4.15
Cleanout Door, N. S	.75	.90	.95	.95	.95
O-1-2 or 3 C. O. Door Frame, N. S	1.50	1.50	1.50	1.50	1.50
Dome, Steam	36.25	49.75	59.25	66.80	93.25
Dome, Water	24.20	32.80	41.50	49.50	69.25
Smoke Ell	4.00	4.50	5.65	8.25	10.30
Check Door	.30	.40	.40	.50	.50
Check Door Ratchet	No Chg.	No Chg.	No Chg.	No Chg.	No Chg.
Smoke Ell Damper	.55	.55	1.40	1.40	1.50
Damper Ratchet	.30	.30	.30	.30	.30
Damper Ratchet Handle	No Chg.	No Chg.	No Chg.	No Chg.	No Chg.
Smoke Ell Complete	5.15	5.75	7.75	10.45	12.70
Smoke Box Clamps	.30	.30	.30	.30	.30

When ordering refer to page 125.

Furman Round Sectional—Continued

NAME OF PARTS	SERIES NUMBER				
	16″	19″	22″	25″	29″
Smoke Box, O. S.	.....	$3.00	$3.75	$4.50	.....
Smoke Box Caps, O. S.	.....	.30	.30	.30	.....
Smoke Box Damper, O. S.	.....	.75	1.15	1.50	.....
Smoke Box Check Door, O. S.	.....	.40	.40	.50	.....
Check Door Frame, O. S.	.....	.50	.50	.50	.....
Smoke Box Complete, O. S	.....	6.75	8.50	9.75	.....
Hinge Pins	$0.30	.30	.30	.30	$0.30
Diaphragm, O. S.	3.00	3.00	3.00	3.00	3.00
Diaphragm, Pres. S.	3.00	3.00	3.00	3.00	3.00
Diaphragm Lever	.30	.30	.30	.30	.30
Diaphragm Plunger	.30	.30	.30	.30	.30
Diaphragm Weight, Small	.30	.30	.30	.30	.30
Diaphragm Weight, Large	.30	.30	.30	.30	.30
Diaphragm Rubber	1.25	1.25	1.25	1.25	1.25
Diaphragm Complete	5.35	5.35	5.35	5.35	5.35
Water Bottle for Diaphragm	2.00	2.00	2.00	2.00	2.00
Water Bottle Connecting Pipe	.30	.30	.30	.30	.30
Steam Trimmings Complete	9.00	9.00	9.00	9.00	9.00
Baffle Plate	.50	.50	.50	.50	.50
Push Nipples	1.00	1.50	1.50	1.50	1.50
Number Plate	.30	.30	.30	.30	.30
Name Plate	.30	.30	.30	.30	.30
Section Connecting Rod	.40	.40	.60	.80	.80
Hoe	.60	.60	.60	.60	.60
Poker	.60	.60	.60	.60	.60
Flue Scraper	.60	.60	.60	.60	.60
Draw Rods, each	.40	.50	.50	.60	.60

NOTE—16″ has 3 grate bars—19″ and 22″ have 4 bars—25″ and 29″ have 6 bars. Grate bars for Furman Rounds made in 3 styles known as 1st, "Old Style" (O. S.), 2nd, "New Style" (N. S.) and 3rd, "Present Style" (Pres. S.). "Old Style" has round keyed shank where gears are placed.

New Style has square shank—otherwise Old Style and New Style are same.

The gear wheels for above styles have round or square holes to match.

Present Styles are separate patterns.

A complete set of Old Style or New Style grate bars with proper gears can be used in old base but cannot be mixed.

Present Style bars can be used only with Present Style Base.

Approximately Round Boilers were shipped with grates as follows: 16″ Old Style and New Style; 19″ Old Style to Serial No. 4036; New Style to No. 6750 and Present Style on all later numbers. 22″ Old Style to No. 3563; New Style to No. 6369 and Present Style on all later numbers.

25″ Old Style to Serial No. 3691; New Style to No. 6324, and Present Style on all later numbers. 29″ Old Style never furnished on this size. New Style to No. 6023 and Present Style on all later numbers.

The Present Style fire pot, domes and rings with large flue openings will be furnished on repair orders for Old Style boilers which had small round openings about 2½″ in diameter. 15″, 18″, 21″, 24″ and 28″ correspond to above respective sizes and represent old numbering system.

There are two long center bars which are shaker bars on all sizes, except 16″ Series which has but one.

When ordering refer to page 125.

Capitol Solar

Old Style and Improved

Boiler No.	Flue Door	Flue Door Lining	Flue Door Frame	Boiler No.	Flue Door	Flue Door Lining	Flue Door Frame
702	$1.15	$0.80	$1.30	1804	$3.75	$3.05	$4.90
1002	1.15	.80	1.30	1805	5.65	3.75	5.00
1003	1.90	1.50	2.80	2403	3.00	1.90	3.05
1004	2.30	1.50	3.05	2404	3.75	3.05	5.65
1402	2.50	.80	1.90	2405	5.65	3.75	5.00
1403	3.00	1.90	3.05	3303	3.00	1.90	3.05
1404	3.75	3.00	4.50	3304	3.75	3.05	5.65
1803	3.00	1.90	3.05	3305	5.65	3.75	5.00

NAME OF PARTS	SERIES NUMBER				
	70 100 16	140 20	180 23	240 26	330 29
Base, Pres. Style, 100 Series	$16.00	.....	.....	.....	.....
Base, Old Style (16 and 70, inclusive)	15.00	$30.00	$35.50	$41.00	$55.00
Ash Pit, Front	3.75	5.00	5.50	6.75	7.50
Ash Pit Door (A. P. D.-26-B) (26)	3.00	5.25	4.50	6.75	6.00
Ash Pit, Drop Door (L. D.-26-B) 23″, 26″, 29″	1.50	1.50	2.10	2.10	2.10
Ash Pit Butterfly Door	1.80	1.80	2.20	2.20	2.20
Grate Ring	3.00	4.50	6.00	8.40	8.85
Grate Bar 1st	1.20	2.40	2.70	2.70	2.85
Grate Bar 2nd	1.50	2.70	3.00	3.75	4.20
Grate Bar 3rd	1.20	2.40	2.70	3.75	4.65
Grate Bar 4th	.....	.....	.....	2.70	4.20
Grate Bar 5th	.....	.....	.....	.....	2.85
Grate Bar Set	3.90	7.50	8.40	12.90	18.75
Shaker Arm (20-23) (26-29)	1.25	1.25	1.25	1.25	1.25
Shaker Bracket, R., 20-8, R, 26-8, 16-20, 23-25-29	.50	.50	.50	.50	.50
Shaker Catch, 20-23-26-29	N. C.	N. C.	N. C.	N. C.	N. C.
Shaker Plates	.30	.30	.30	.30	.30
Shaker Handle	1.20	1.20	1.20	1.20	1.20
Shaker Offset Rod	1.00	1.00	1.20	1.40	1.60
Connecting Rod	.80	.80	1.00	1.00	1.20
Wedges for Grate Rings 3/16-3/20-4/23-26-29	.30	.30	.30	.30	.30
Fire Pot	83.75	119.00	140.00	167.50	207.50
Fire Pot, 16 Series	60.00	.....	.....	.....	.....
Fire Door, 20-23-26	2.62	4.30	4.30	4.30	6.00
Fire Door Frame	5.65	6.75	6.00	6.75	9.00
Fire Door Lining, 20-23-26	1.50	1.90	1.90	1.90	3.40
Fire Door Vent	.30	.30	.30	.30	.30
Fire Door Handles	.50	.50	.50	.50	.50
Clinker Door, 20-23-26-29	1.50	1.50	1.50	1.50	1.50
Clinker Door Frame	2.65	2.65	2.65	2.65	2.65
Clinker Door Lining, 20-23-26-29	.60	.60	.60	.60	.60
Small Door Handles	.70	.70	.70	.70	.70
Center Hole Section	.....	35.50	39.00	46.50	69.50
Outer Hole Section	.....	36.20	42.00	53.00	60.25
Outer and Center Hole Section	.....	33.75	47.00	49.75	59.50

When ordering refer to page 125.

Capitol Solar—Continued

Old Style and Improved

NAME OF PARTS	SERIES NUMBER				
	70 100 16	140 20	180 23	240 26	330 29
Intermediate 100 Series 2 Nipple Sec..	17.50	.....	.....	.....	.....
Intermediate 16 & 100 Series 3 Nip. Sc.	27.50	.....	.....	.....	.....
Topheader (Steam)	38.00	57.00	68.75	102.50	121.75
Topheader (Water)	27.50	34.75	40.50	49.50	58.75
Smoke Hood Only	3.75	4.70	9.00	12.00	15.00
Smoke Hood Check Door	.50	.80	.80	.80	.80
Smoke Hood Neck	1.20	1.20	1.50	2.00	3.00
Smoke Hood Door Frame	.50	.80	.80	.80	.80
Smoke Hood Indicator Plate	.30	.30	.30	.30	.30
Smoke Hood Damper	.60	1.68	1.90	2.25	3.00
Smoke Hood Ratchet	.30	.30	.30	.30	.30
Smoke Hood Damper Rod	.40	.40	.50	.60	.60
Smoke Hood Damper Catch	.30	.30	.30	.30	.30
Smoke Hood Damper Handle	.30	.30	.30	.30	.30
Smoke Hood Complete	7.50	9.75	15.00	18.75	24.00
Diaphragm	3.00	3.00	3.00	3.00	3.00
Diaphragm Lever	.30	.30	.30	.30	.30
Diaphragm Plunger	.30	.30	.30	.30	.30
Diaphragm Rubber	1.25	1.25	1.25	1.25	1.25
Diaphragm Weight	.50	.50	.50	.50	.50
Diaphragm Complete	5.35	5.35	5.35	5.35	5.35
Steam Trimmings Complete	12.50	12.50	12.50	12.50	12.50
Water Column	3.00	3.00	3.00	3.00	3.00
Section Connecting Bolt	.40	.40	.40	.50	.50
Nipples	.75	.75	.75	.75	.75
Hoe	.80	.80	.80	1.00	1.00
Poker	1.00	1.00	1.00	1.00	1.00
Flue Brush	1.25	1.25	1.25	1.25	1.25
Flue Brush Handle	.40	.40	.40	.40	.40
No. Grate Bars Each Series	Three	Three	Three	Four	Five

Capitol Solar Boilers were made with both two and three nipple connections and at different times with three nipple sizes.

When ordering refer to page 125.

Capitol Improved Square Sectional

25-37 and 48 Series A or B Styles

Size	Top Header	R. or L. Cored Base	R. or L. Sub-Base Side	Conn. Rod R.	Conn. Rod L.
425–1425	$16.80	$22.50	$5.20	$1.00	.....
525–1525	20.50	25.20	7.00	1.20	$0.80
625–1625	24.20	28.20	8.80	1.40	1.00
725–1725	28.00	31.00	9.40	1.60	1.20
825–1825	31.20	34.00	10.80	1.80	1.40
537–1537	40.00	29.00	7.20	1.80	1.40
637–1637	48.50	33.00	9.50	2.00	1.60
737–1737	57.00	37.00	10.20	2.20	1.80
837–1837	65.50	41.00	11.70	2.40	2.00
937–1937	74.00	45.00	12.50	2.60	2.20
1037–2037	82.50	49.00	13.80	2.80	2.40
648–	104.00	52.50	12.40	2.40	1.80
748–1748	120.00	58.50	12.80	2.80	2.20
848–1848	136.00	64.00	14.80	3.20	2.60
948–1948	152.50	69.50	15.20	3.60	3.00
1048–2048	169.00	75.00	17.50	4.00	3.40
1148–2148	185.00	80.00	18.80	4.40	3.80
1248–2248	200.00	86.00	22.00	4.80	4.20
1348–2348	218.00	92.00	25.20	5.20	4.60

NAME OF PARTS	SERIES NUMBER				
	25-A		25-B	37″	48″
	Steam	Water			
Front Half Section, R. or L.	$23.20	$21.40	$22.80	$43.20	$87.60
Intermediate Half Section, R. or L.	21.20	19.20	19.20	35.20	60.60
Flue Half Section, R. or L.	21.20	18.80	.....	34.20	60.00
Skeleton Half Section, R. or L.	18.20	15.60	17.40	28.40	48.20
Area Half Section, R. or L.	21.40	19.20	.....	35.00	60.60
Back Half Section, R. or L.	25.00	23.60	25.00	48.00	93.60
Ash Pit Front	9.00	9.00	9.00	11.50	.....
Ash Pit Front, R. or L.	.....	.....	.....	.....	11.50
Ash Pit Door	3.00	3.00	3.00	2.50	5.00
Ash Pit Door Frame	.....	.....	.....	.....	4.40
Ash Pit Drop Door or Butterfly Door	1.00	1.00	1.00	1.40	1.80
Ash Pit Drop Door Ratchet	N. C.	N. C.	N. C.	N. C.	N. C.
Ash Pit Door Handle	.70	.70	.70	.70	.70
Front Distance Piece	1.80	1.80	1.80	2.40	7.00
Sub-base End	4.80	4.80	4.80	7.00	8.40
Grate Bars, Coarse A	3.40	3.40	3.40	5.40	7.80
Grate Bars, Peacoal A	3.30	3.30	3.30	5.20	9.20
Grate Bars, Coarse B	3.40	3.40	3.40	5.20	10.40
Grate Bars, Peacoal B	3.30	3.30	3.30	5.20	11.50
Connecting Rod Support	.60	.60	.60	.60	.80
Shaker Slide	.60	.60	.60	.60	.60
Shaker Bracket	.60	.60	.60	.60	.60
Shaker Arm	.80	.80	.80	1.40	1.40
Shaker Handle	1.40	1.40	1.40	1.40	1.40
Shaker Link	.60	.60	.60	.60	.60
Fire Door	4.00	4.00	4.00	4.40	.....
Fire Door, R. or L.	.....	.....	.....	.....	6.00
Fire Door Frame	6.00	6.00	6.00	8.00	.....

When ordering refer to page 125.

Capitol Improved Square Sectional—Continued

25-37 and 48 Series A or B Styles

NAME OF PARTS	SERIES NUMBER				
	25-A		25-B	37"	48"
	Steam	Water			
Fire Door Lining	$1.80	$1.80	$1.80	$2.30	.....
Fire Door Lining, R. or L.	.....	.....	.....	.....	$4.50
Fire Door Handle	.70	.70	.70	.70	.80
Fire Door Slide	.60	.60	.60	.60	.60
Fire Door Pin	N. C.	N. C.	N. C.	N. C.	N. C.
Clinker Door, O. S.	1.30	1.30	1.30	.....	1.40
Clinker Door, Pres. S.	.....	.....	.....	1.40	.....
Clinker Door, Pres. S., R. or L.	.....	.....	.....	.....	1.40
Clinker Door Lining	1.00	1.00	1.00	.60	.60
Clinker Door Handle	.60	.60	.60	.60	.80
Cleanout Door, R. or L.	1.20	1.20	1.20	2.40	5.00
Cleanout Door Lining, R. or L.	1.20	1.20	1.20	1.80	3.00
Small Door Handles	.60	.60	.60	.60	.60
Latch Plate	.60	.60	.60	.60	.60
Hinge Plate	.60	.60	.60	.60	1.00
Hinge Plate, C. O. Door, R. or L.	.....	.....	.....	.....	1.40
Center Strip	.....	.....	.....	.60	1.50
Center Strip, Water or Steam	.60	.60	.60	.....	.....
Smoke Hood only	.....	.....	.....	20.00	24.50
Smoke Hood Damper	1.50	1.50	1.50	4.00	2.50
Smoke Hood Damper Rod	.60	.60	.60	.60	.60
Smoke Hood Check Door	.90	.90	.90	1.40	2.50
Smoke Hood Ratchet, R. or L.	.60	.60	.60	.60	.60
Smoke Hood Indicator Plate	.60	.60	.60	.60	.60
Smoke Hood Indicator Catch	N. C.	N. C.	N. C.	.60	.60
Smoke Hood Indicator Handle	.60	.60	.60	.60	.60
Smoke Hood Complete	12.50	12.50	12.50	27.40	33.00
Bridgewall Plates, A Style	.....	.....	.....	17.30	.....
Bridgewall Plates, B Style	.....	.....	.....	17.70	.....
Bridgewall Plates, R. or L., A or B Style	.....	.....	.....	4.50	16.50
Water Column	3.00	3.00	3.00	3.00	7.00
Water Column Pipe Connections	3.00	3.00	3.00	3.50	4.00
Diaphragm	4.50	4.50	4.50	4.50	4.50
Diaphragm Plunger	.60	.60	.60	.60	.60
Diaphragm Lever or Plunger	.60	.60	.60	.60	.60
Diaphragm Weight	1.00	1.00	1.00	1.00	1.00
Diaphragm Rubber	2.00	2.00	2.00	2.00	2.00
Diaphragm Complete	10.60	10.60	10.60	10.60	10.60
Steam Trimmings Complete	17.50	17.50	17.50	17.50	24.00
Number Plate	N. C.	N. C.	N. C.	N. C.	N. C.
Upper Nipple	.60	.60	.60	1.00	1.20
Lower Nipple	.60	.60	.60	.60	.80
Lower Nipple, A Style	.....	.....	.....	.80	.....
Rear Base Nipple	.80	.80	.80	1.00	1.00
Upper Connecting Bolt	.60	.60	.60	.60	.80
Lower Connecting Bolt	.60	.60	.60	.60	.60
Rear Base Connecting Bolt	.60	.60	.60	.80	.80
Hoe	1.00	1.00	1.00	1.50	2.00
Poker	1.50	1.50	1.50	2.00	2.40
Flue Brush	1.50	1.50	1.50	2.00	2.50

One less grate bar than number of sections contained in above series of boilers having standard size grate. Grates reduced by bridge wall plates on 37 and 48 Series have special number of bars.

When ordering refer to page 125.

Capitol 200 and 250 Series

NAME OF PARTS	SERIES NUMBER	
	200	250
Front Section	$56.40	$82.20
Reg. Intermediate Section	47.60	78.60
Tapped Intermediate Section	48.00	81.60
Back Section	58.00	91.40
Base Front	5.10	6.30
Top Back Base Plate	1.80	2.70
Bottom Back Base Plate	2.10	1.75
Base Side R. H.	4.65	6.90
Base Side L. H.	4.65	7.28
Base Side R. H., 1 Grade Extension	1.65	1.65
Base Side L. H., 1 Grade Extension	1.60	1.65
Base Side R. H., 2 Grade Extension	3.00	3.30
Base Side L. H., 2 Grade Extension	3.50	3.30
Ash Pit or Base Door	2.25	2.90
Ash Pit or Base Door Slide	.40	.40
Ash Pit or Base Door Hinge Pin	.30	.30
Grate Bar Intermediate (Small Mesh)	3.45	4.90
Grate Bar Intermediate (Coarse)	3.10	4.90
Grate Bar (Front Half)	.65	2.00
Grate Lug	.45	.55
Front Conn. Bar R. H.	1.15	1.40
Front Conn. Bar L. H.	.....	1.60
Conn. Bar Extension R. H. (1 Grate)	.60	.60
Conn. Bar Extension R. H. (2 Grate)	.95	1.05
Conn. Bar Extension R. H. (3 Grate)	1.25	1.30
Conn. Bar Extension R. H. (4 Grate)	1.60	1.75
Conn. Bar Bracket	.....	.50
Shaker Arm	1.05	1.05
Shaker Link	.50	.75
Shaker Catch	.50	.50
Shaker Handle	1.25	1.25
Fire Door	3.50	3.50
Fire Door Lining	1.75	1.75
Fire Door Vent or Wheel	.30	.30
Fire Door Hinge Plate	.50	.50
Fire Door Catch Plate	.30	.30
Fire Door Handle	.30	.30
Fire Door Hinge Pin	.30	.30
Clinker Door	1.25	1.50
Clinker Door Lining	.65	.75
Clinker Door Hinge Pin	.30	.30
Cleanout Door R. or L.	1.50	1.65
Cleanout Door Handle	.30	.50
Cleanout Door Handle Latch or Key	.30	.30
Cleanout Door Hinge Lug Plate	.30	.30
Cleanout Door Hinge Pin	.30	.30
Smoke Hood Open Half Top Opening	4.00	4.80
Smoke Hood Close Half Top Opening	3.40	4.50
Smoke Hood Damper	.65	.90
Smoke Hood Damper Arm	.30	.30
Smoke Hood Damper Arm Angle Lever	.50	.50
Smoke Hood Check Draft Door	.50	.50
Smoke Hood Check Draft Door Ratchet	.30	.30
Smoke Hood Complete (Top Opening)	10.50	12.50
Smoke Hood Complete (Rear Opening)	9.75	11.00

When ordering refer to page 125.

Capitol 200 and 250 Series—Continued

NAME OF PARTS	SERIES NUMBER	
	200	250
Smoke Hood Open (Half Rear Opening)	$3.40	$3.75
Smoke Hood Closed (Half Rear Opening)	3.00	3.50
Base Side Draft Door	.50	.50
Base Side Draft Door Frame	.60	.65
Base Side Draft Door Lever	.30	.30
Base Side Draft Door Ratchet	.30	.30
Short Damper Arm Rod	.30	.30
Long Damper Rods 4 Section	1.00	.....
Long Damper Rods 5 Section	1.10	1.20
Long Damper Rods 6 Section	1.20	1.40
Long Damper Rods 7 Section	1.30	1.60
Long Damper Rods 8 Section	.....	1.80
Short Damper Rods	.30	.30
Front Lever Arm or Standard	.50	.50
Front Damper Rod Handle	.50	.50
Rear Damper Arm or Rear Standard	.50	.50
Coil Hole Cover	.30	.30
Baffle Plate	.50	.....
Water Column	2.50	2.50
Water Column Conn.	3.00	3.00
Diaphragm Metal Comp.	6.35	6.35
Diaphragm Only (Metal)	4.00	4.00
Diaphragm, O. S.	3.00	3.00
Diaphragm Lever	.30	.30
Diaphragm Weight (Small)	.50	.50
Diaphragm Weight (Large)	.85	.85
Diaphragm Plunger	.35	.35
Diaphragm Rubber	1.25	1.25
Diaphragm Complete, O. S.	3.50	5.65
Steam Trimmings Complete	.....	15.50
Nipple 3″	.75	.80
Nipple, 4″	1.00	1.00
Draw Clamp, 3″	1.25	1.25
Draw Clamp, 4″	1.25	1.25
Draw Rods 4 Section Set 4	1.60	.....
Draw Rods 5 Section Set 4	2.00	2.00
Draw Rods 6 Section Set 4	2.60	2.60
Draw Rods 7 Section Set 4	2.60	2.60
Draw Rods 8 Section Set 4	.....	2.80
Flue Brush	.....	1.10
Poker	.....	1.50
Hoe	.....	1.25

When ordering refer to page 125.

Capitol Smokeless Boiler

400 and 500 Series

NAME OF PARTS	SERIES NUMBER	
	400	500
Front Section	$184.00	.....
Front Section, R. H	.....	$90.60
Front Section, L. H	.....	91.20
Next-To-Front Section, Plain	120.75	.....
Next-To-Front R. H. Water Col	.....	80.80
Next-To-Front Section, Tapped	123.05	.....
Next-To-Front L. H	.....	81.20
Plain Middle Section	121.90	.....
Plain Middle Section, R. H. or L. H	.....	82.00
Tapped Middle Section	124.20	.....
Plain Middle Section, Tapped R. H. or L. H	.....	84.60
Curtain Wall Section	135.70	.....
Curtain Wall, R. H	.....	104.00
Curtain Wall, L. H	.....	104.00
Bridgewall Section	169.05	.....
Bridgewall Section, R. H	.....	100.20
Bridgewall Section, L. H	.....	100.20
Middle Next-To-Back Section, Tapped R. H	.....	83.60
Middle Next-To-Back Section, Tapped L. H	.....	83.60
Middle Next-To-Back Section, Plain R. H	.....	81.80
Middle Next-To-Back Section, Plain L. H	.....	81.80
Water Column Section	.....	80.80
Safety Valve Section	121.90	83.60
Next-To-Back Section	120.75	.....
Back Section, R. H	.....	113.10
Back Section, L. H	.....	113.10
Back Section	170.20	.....
Air Flue Guard (Bracket)	1.00	.....
Ash Pit Door	3.45	6.40
Ash Pit Door Slide	.....	.50
Ash Pit Flap Door	2.45	1.40
Ash Pit Door Slide Handle	.....	.50
Ash Pit Door Ratchet	.30	.....
Ash Pit Door Handle	.....	.50
Ash Pit Door Chain Lever	.30	.....
Ash Pit Door Flap Door Hinge Pin	.30	.30
Ash Pit Door Hinge Pin	.30	.30
Baffle Plate	.....	2.35
Base Back	.....	13.30
Base Back Opening Plate	.....	2.10
Base Back Opening Plate Liner	.....	1.50
Base Back Plate Catch	.....	.30
Base Front	10.50	35.55
Base Front Washers	.....	.30
Base Side R. H. with Opening, 5 Section, 4 Pokt	.....	16.50
Base Side L. H. without Opening, 5 Section, 4 Pokt	.....	19.20
Base Side R. H., 1 Pocket Ex	.....	4.95
Base Side L. H., 1 Pocket Ex	.....	4.95
Base Side R. H., 2 Pocket Ex	.....	10.20
Base Side L. H., 2 Pocket Ex	.....	10.20
Base Side R. H., 3 Pocket Ex	.....	13.80
Base Side L. H., 3 Pocket Ex	.....	13.80
Base Side R. H., 4 Pocket Ex	.....	19.20
Base Side L. H., 4 Pocket Ex	.....	19.20

When ordering refer to page 125.

Capitol Smokeless Boiler—Continued

400 and 500 Series

NAME OF PARTS	SERIES NUMBER	
	400	500
Base Side Cold Air Frame	.....	$5.40
Base Side Cold Air Frame Lid	.....	1.75
Bridgewall Plate	.....	16.80
Bridgewall Plate Liner	.....	11.00
Front Closing	.....	1.45
Rear Side Cleanout Frame	$0.50	.....
Rear Side Cleanout Cover	.50	.....
Clinker Door, R. H	.....	1.00
Clinker Door, L. H	.....	1.00
Clinker Door	1.90	.....
Clinker Door Liner, R. H	.....	1.00
Clinker Door Liner	1.25	.....
Clinker Door Liner, L. H	.....	1.00
Clinker Door Handle	.....	.50
Clinker Door Handle Catch	.....	.30
Clinker Door Hinge Pin	.....	.30
Connecting Rod Bracket or Support	.....	1.90
Diaphragm Comp. Metal	6.55	6.55
Diaphragm Only, Metal	4.00	4.00
Diaphragm, O. S	.....	3.00
Diaphragm Lever	.30	.30
Diaphragm Lever Link	.30	.30
Diaphragm Weight, Large	.50	.50
Diaphragm Weight, Small	.40	.40
Diaphragm Conn. Pipe	.50	.50
Diaphragm Rubber	1.25	1.25
Diaphragm Top	.....	1.50
Diaphragm Bottom	.....	1.50
Diaphragm Weight Thumb Screw	.30	.30
Diaphragm Plunger	.....	.30
Diaphragm Complete, O. S.	.....	6.35
Domestic Coil Plate	.....	.30
Draw Clamp, Upper	1.50	1.50
Draw Clamp, Lower	1.50	1.50
Steam Trimmings Complete	12.00	14.00
Fire Clay Tile (4) each	2.00	2.00
Liner Tile Brick	.....	1.00
Fire Door	4.50	.....
Fire Door, R. H. or L. H	.....	4.50
Fire Door Lining	1.90	.....
Fire Door Lining, R. H. or L. H	.....	2.25
Fire Door Draft Wheel	.....	.50
Fire Door Handle	.30	.50
Fire Door Catch	.30	.50
Fire Door Hinge Plate	.50	.60
Fire Door Hinge Pin	.30	.30
Number Plate	No Charge	No Charge
Flue Door, R. H. or L. H. (Upper)	4.25	.....
Flue Door, R. H. or L. H. (Lower)	2.40	.....
Flue or Cleanout Door, R. H	.....	10.90
Flue or Cleanout Door, L. H	.....	10.90
Flue Door Hinge Plate, Upper	.50	.....
Flue Door Hinge Plate, Lower	.50	.....
Flue or Cleanout Door Handle	.75	.50

When ordering refer to page 125.

Capitol Smokeless Boiler—Continued

400 and 500 Series

NAME OF PARTS	SERIES NUMBER 400	500
Flue or Cleanout Door Catch	$0.30	$0.30
Flue or Cleanout Door Hinge Plate	.....	1.00
Flue or Cleanout Door Hinge Pin	.....	.30
Flue Brush	1.30	1.30
Flue Brush Handle	.50	.50
Grate Lug	.50	.....
Grate Connecting Bar, L. H. Front	2.55	2.55
Grate Connecting Bar, R. H. Front	2.45	2.55
Grate Connecting Bar, 1 Grate Extension	.75	.....
Grate Connecting Bar, 2 Grate Extension	1.30	.....
Grate Connecting Bar, 3 Grate Extension	1.85	.....
Grate Connecting Bar, 4 Grate Extension	2.35	.....
Grate Bar Middle	8.05	11.90
Grate Bar (Special)	6.50	10.00
Grate Bar (Front Half)	.....	4.30
Nipples, C. I. Top 5¾"	.....	1.50
Nipples, C. I. Bottom 4¼"	.....	1.00
Nipples, 6"	1.50	.....
Rear Base Side R. H. (Made for 3 Section only)	.....	11.20
Rear Base Side L. H. (Made for 3 Section only)	.....	11.20
Rear Base Side (1 Section Extension) R. H.	.....	3.90
Rear Base Side (1 Section Extension) L. H.	.....	3.90
Rear Base Side Liner, R. H. or L. H.	.....	1.50
Rear Base Side Cleanout Door	.....	.50
Rear Base Side Cleanout Door Frame	.....	.50
Rear Base Side Cleanout Door Liner	.....	.30
Scraper Blade	.....	.50
Shaker Connecting Link	.30	.....
Shaker Handle	.60	.60
Shaker Arm	2.25	2.45
Shaker Arm Pin—⅝" x 3"	.....	.30
Shaker Arm Pin Cotter Pin—⅜" x 1½"	.....	.30
Shaker Bracket	.....	1.00
Shaker Slide Catch, R. H.	.30	.30
Shaker Slide Catch, L. H.	.30	.30
Long Conn. Bar per Grate	.....	.50
Slice Door	.....	.50
Slice Door Liner	.....	.30
Slice Door Hinge Pin	.....	.30
Smoke Hood Cover	3.45	.....
Smoke Hood Open Half, R. H. (Rear Opening)	10.00	13.80
Smoke Hood Closed Half, L. H. (Rear Opening)	10.00	17.00
Smoke Hood Open Half, R. H. (Top Outlet)	10.00	28.25
Smoke Hood Closed Half, L. H. (Top Outlet)	10.00	31.50
Smoke Hood Front Operating Rod Bracket	.75	.....
Smoke Hood Back Operating Rod Bracket	.75	.....
Smoke Hood Operating Rod	1.00	.....
Smoke Hood Operating Angle Lever	.50	.....
Smoke Hood Check Draft Door	1.60	1.15
Smoke Hood Operating Connecting Link	.30	.....
Smoke Hood Damper	3.75	6.25
Smoke Hood Operating Rod Handle	.50	.....
Smoke Hood Damper Rod W. I.	.30	.30
Smoke Hood Segmental Gauge	$0.30	$0.50

When ordering refer to page 125.

Capitol Smokeless Boiler—Continued

400 and 500 Series

NAME OF PARTS	SERIES NUMBER	
	400	500
Smoke Hood Segmental Gauge Catch	.....	.30
Smoke Hood Complete Back Outlet	33.20	39.25
Smoke Hood Complete Top Outlet	33.20	68.00
Tie or Draw Up Rods, 8 Section	5.00	5.00
Tie or Draw Up Rods, 9 Section	5.80	5.80
Tie or Draw Up Rods, 10 Section	6.40	6.40
Tie or Draw Up Rods, 11 Section	7.00	7.00
Tie or Draw Up Rods, 12 Section	7.60	7.60
Tie or Draw Up Rods, 13 Section	8.20	.....
Tie or Draw Up Rods, 14 Section	8.80	.....
Water Column	4.00	4.00
Water Column Connection	3.00	3.00
Tile Spacer	.75	.75
Cast Iron Washer 2½" at Top of Plate	.....	.30
Inside Washer for Center Strip	.....	.30
Cast Iron Washer for Smoke Hood 2½"	.....	.30
Slice Bar	5.00	5.00
Hoe or Scraper	1.00	1.00

When ordering refer to page 125.

Hot Water Supply Boilers

NAME OF PARTS	SIZE NUMBER				
	2X	119	120	62 Sunray	63 Sunray
Ashpit Door	$1.10	$1.80	$1.80	$1.80	$1.80
Ashpit Door Slide	.30	.40	.40	.40	.40
Ashpit Door Handle	.30	.30	.....	.....	.....
Ashpit Door Catch	.....	.30	.....	.....	.....
Base	3.00	10.50	12.25	12.75	12.75
Base Bottom	2.00	6.75	9.00	9.00	9.00
Base Front	.....	1.40	1.50	1.50	1.50
Cylinder	10.50	18.65	26.25	42.75	49.50
Cross Piece	.75	.75	.....	.....	.....
Fire Door	1.10	.....	1.30	1.50	1.50
Grate	.45	.....	.....	.....	.....
Lids (2)	.75	1.10	1.90	.....	.....
Legs	.70	.70	.70	.70	.70
Shaker Grate	.45	.....	.....	.....	.....
Shaker Handle	.30	.90	.90	.90	.90
Square Deflective Plate	.40	.....	.....	.....	.....
Top Plate	4.80	.....	.....	.....	.....
Under Top Bowl	6.00	.....	.....	.....	.....
Oval Top	.....	7.00	.....	.....	.....
Cog Wheels (3)	.....	.50	.50	.50	.50
Deflector	.....	.85	.....	.....	.....
Grates—Side (2) 3 per New Style	.....	.60	.....	.....	.....
Grate—Shaker (1) set New Style	.....	.90	.....	.....	.....
Smoke Collar	.....	.65	.....	.....	.....
Bowl or Under Top	.....	10.50	.....	.....	.....
Center Piece or Bridge	.50	.75	.....	.....	.....
1 Cylinder Ring	.....	2.10	.....	.....	.....
2 Side Grates (3) per Old Style	.....	.55	.....	.....	.....
1 Center Shaker Grate Set Old Style	.....	.80	.....	.....	.....
Under Top	4.00	.....	4.80	.....	.....
Top	3.25	.....	3.25	.....	.....
Grate Rest	.....	.....	.75	.75	.75
1 Shaker Grate, New Style	.....	1.00	1.30	1.30	1.30
1 Right Side Grate, New Style	.....	.....	1.00	.....	.....
1 Left Grate	.....	.....	1.00	.....	.....
Lid—Top	.75	1.60	1.90	.....	.....
Plate—Deflecting	.....	.....	.80	.....	.....
2 Side Grate Bars, Old Style	.....	.....	.80	.....	.....
2 Center Grate Bars, Old Style	.....	.....	1.00	.....	.....
Fire Door Frame	.....	.....	.....	1.90	1.90
Rear Grate Rest	.....	1.25	.....	1.25	.....
Grate Bar Center (1) New Style	.....	.....	.....	1.60	.....
Grate Bar Short (2) New Style	.....	.....	.....	1.00	.....
Water Dome	.....	.....	.....	21.25	21.25
Clinker Door	.....	.....	.....	.50	.50
Clinker Door Frame	.....	.....	.....	.50	.50
Grate R. H. Shaker, Old Style	.....	1.00	1.00	1.00	1.00
Grate L. H. Shaker, Old Style	.....	1.00	1.00	1.00	1.00
Grate R. H. Side, Old Style	.....	.60	.75	1.00	1.00
Grate L. H. Side, Old Style	.....	.60	.75	.75	.75
Side Grate (2), New Style	.....	.....	1.00	1.00	1.00
Nipple	.....	.....	.....	.30	.30
Check Frame Complete	.....	1.00	1.00	1.40	1.40

NOTE.—Hot water supply boilers were furnished with two different patterns of grate bars.

It will be impossible to ship grate bars for the size No. 119 Heater, unless we know the serial number, or have a sketch of the needed grates.

With sizes No. 120, No. 62, and No. 63 Heaters, two different styles of grates are furnished, the old style employing four grate bars and the new style three grate bars.

When ordering, refer to page 125.

Radiator Repairs

IN ordering repairs for radiators, much time and annoyance will be saved if the order clearly states all details of part wanted. Many times an incomplete description or lack of sketch showing details of part wanted makes it necessary for several letters to pass back and forth before the proper shipment can be made.

When the part is for a radiator of special construction, a sketch should also accompany written description on order.

When ordering radiator sections mention the following: Name of radiator, pattern of radiator, height of radiator, whether end leg section, center leg section, or regular intermediate section, and if supply or return end leg section or blank end leg section (for one-pipe steam) is wanted, also state if for steam or water, one or two-pipe work, slip nipple or screw nipple connection and high or low drip hubs. If water radiators are being used for steam this fact should also be mentioned.

Orders for indirect radiator repairs should clearly state whether end or intermediate section is wanted and whether blank or tapped when an end section. A sketch of section showing position of desired tappings, should be sent with order. Also state whether slip nipple or screw nipple connection is wanted.

Special Note

Repairs for radiators not illustrated in this catalogue will be charged at higher prices than standard goods.

Radiator Price List and Rating Per Section in Square Feet

Height in inches	45	44	38	32	26	22	20	18	17	15	14
Price per square foot, cents	70	70	70	76	84	88	96	1.00	1.02	1.06	1.08
One-column, Steam and Water											
Triton	...	...	3	2½	2	1⅔	1½	...	...	...	...
Florentine	...	...	3	2½	2	1⅔	1½	...	...	...	...
Triton Hospital	...	...	3	2½	2	1⅔	1½	...	...	...	...
Two-column, Steam and Water											
Triton	5	...	4	3⅓	2⅔	2¼	2	...	...	1½	...
Florentine	5	...	4	3⅓	2⅔	2¼	2	...	...	...	...
Triton Hospital	5	...	4	3⅓	2⅔	2¼	2	...	...	...	...
Three-column, Steam and Water											
Triton	6	...	5	4½	3¾	3	...	2¼	...	...	...
Florentine	6	...	5	4½	3¾	3	...	2¼	...	...	...
Triton Hospital	6	...	5	4½	3¾	3	...	2¼	...	...	...
Four-column, Steam or Water											
Triton	...	10	8	6½	5	4	...	3	...	...	...
Florentine	...	10	8	6½	5	4	...	3	...	...	...
Five-column, Steam or Water											
Triton Window	...	...	...	...	...	...	5½	...	4¾	...	4

Triton Wall Radiators

For Steam or Water

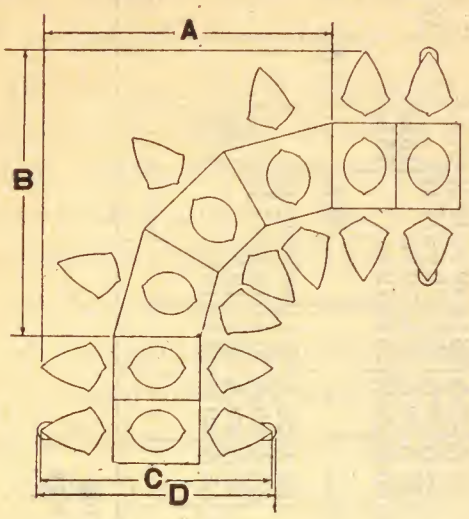
Extra large section, 9 square feet, per square foot $0.76
Standard section, 7 square feet, per square foot ..... .76
Small section, 5 square feet, per square foot ..... .90

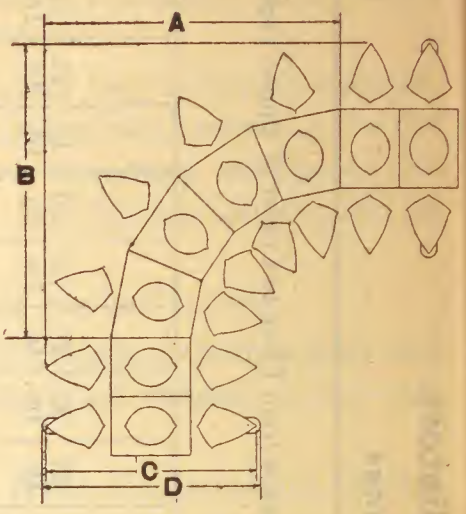
Pin Indirect Radiators

For Steam or Water

10 foot section, price per section $5.00
15 foot section, price per section 7.50
20 foot section, price per section 10.00

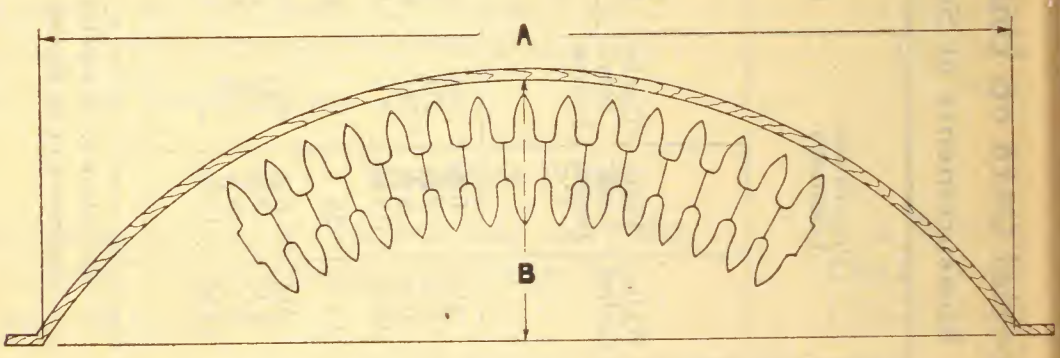
Measurements for Triton Radiators



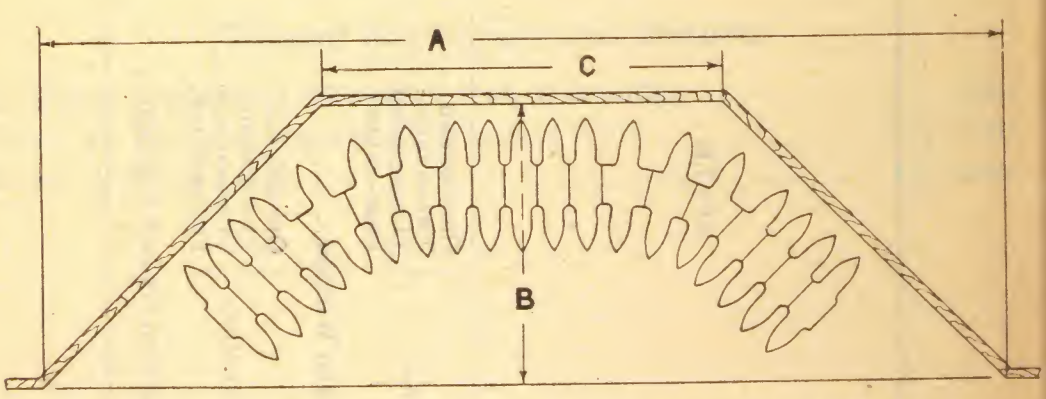


	A and B	C	D
1 Col.	9	4½	5 1/32
2 Col.	10¼	7⅛	7 13/32
3 Col.	11¼	9	9 5/16
4 Col.	14⅞	12½	12 13/16
5 Col.	16	13	13

A and B	C	D
10⅜	4½	5 1/32
11⅝	7⅛	7 13/32
12⅝	9	9 5/16
16¼	12½	12 13/16
17 11/16	13	13

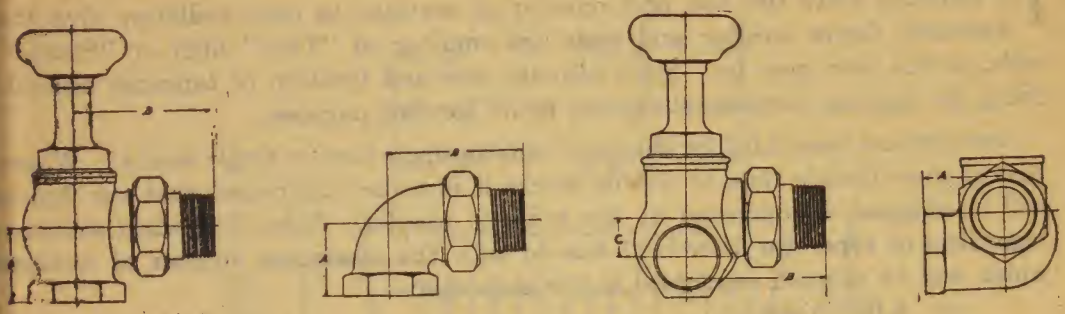


When ordering curved radiators, give measurements A and B



When ordering bay window radiators, give measurements A, B and C

Roughing-in Measurements of Valves and Elbows



Size, Inches		½	¾	1	1¼	1½	2
512, 112, 312, 412	A	1¼	1⅜	1⅝	1⅞	2 3/32	2½
512, 112, 312, 412	B	2 13/32	2¾	3 3/32	3 7/16	3⅞	4 21/32
522, 523	A	1¼	1⅜	1⅝	1⅞	2 3/32	...
522, 523	B	2 13/32	2¾	3 3/32	3 7/16	3⅞	...
202	A	1	1 3/16	1 13/32	1⅝	1 27/32	2 19/64
202	B	2 7/16	2¾	3 1/16	3 7/16	3 15/16	4 9/16
42	A	1¼	1¼	1½	1 21/32	2	2 9/32
42	B	2 13/32	2⅝	3 3/16	3⅜	3¾	4 17/32
612, 212	A	1¼	1½	1¾	1 31/32	2 11/32	2⅝
612, 212	B	2 13/32	2⅞	3¼	3½	4	4 25/32
612, 212	C	9/16	¾	13/16	15/16	1 5/16	1 17/32
622, 623	A	1¼	1½	1¾	1 31/32	2 11/32	...
622, 623	B	2 13/32	2⅞	3¼	3½	4	...
622, 623	C	9/16	¾	13/16	15/16	1 5/16	...

Wall Radiators

IN ordering state the size and number of sections to each radiator, give the assembly figure number and state the number of "Tiers" high or "Stacks" wide, as the case may be. State also the size and location of tappings desired, using the tapping numbers shown on figure for this purpose.

Sections are assembled for shipment only in single tiers or single stacks. Where figures show double tiers or double stacks it is to be understood that the figures will be shipped disconnected at the hexagon nipples. Note that when sections, regardless of type. are assembled side to side, the maximum number of sections which will be shipped assembled is, for each size:—

5 ft.—5 section
7 ft.—5 sections
9 ft.—5 sections
See Figures 9—11—13—15—2—6

And when assembled end to end the maximum number of sections which will be shipped assembled is, for each size:—

5 ft.—5 sections
7 ft.—4 sections
9 ft.—3 sections
See Figures 1—3—5—7—15—8—10—12

The regular tappings as shown on the various assembly figures are indicated by 2, 3, 4, 5, 6, 7, 8 and 9. 12, 13, 14, 15, 16, 17, 18, 19 indicate special tappings which can be furnished at points so marked if required and for which an extra charge of 10 cents each, net, will be made.

Numbers 2, 9, 3, 4, and 12, 19, 13, 14 are left hand tappings.

Numbers 5, 6, 7, 8 and 15, 16, 17, 18 are right hand tappings.

Tappings are 1½" supply and return and are bushed as per list on page 150.

Crating

Units of TRITON Wall Radiators are crated as follows:—

Horizontals, 7 Foot and 9 Foot

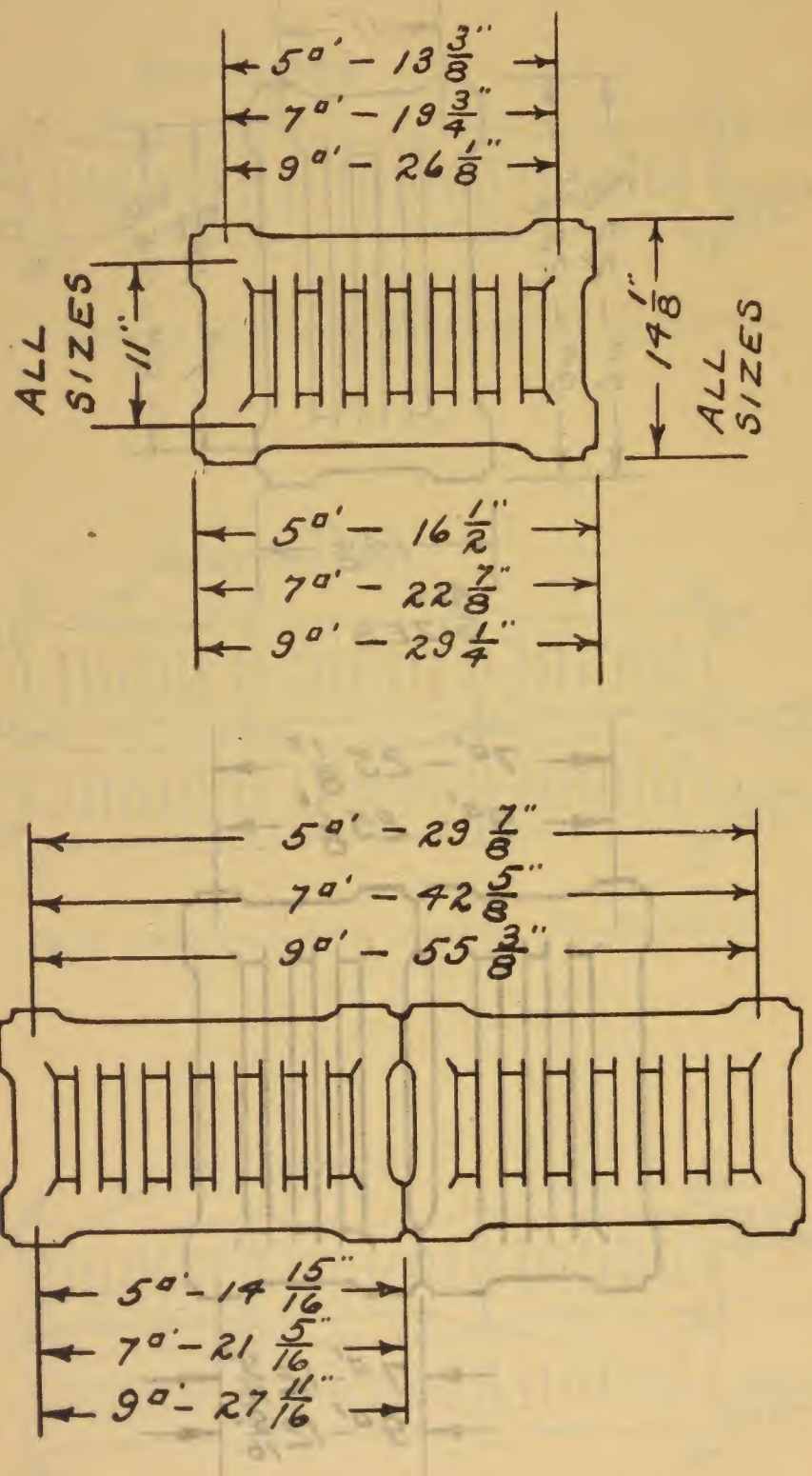
When assembled as per figure 1—3 sections and over.
When assembled as per figure 9—5 sections and over.

Vertical, 7 Foot and 9 Foot

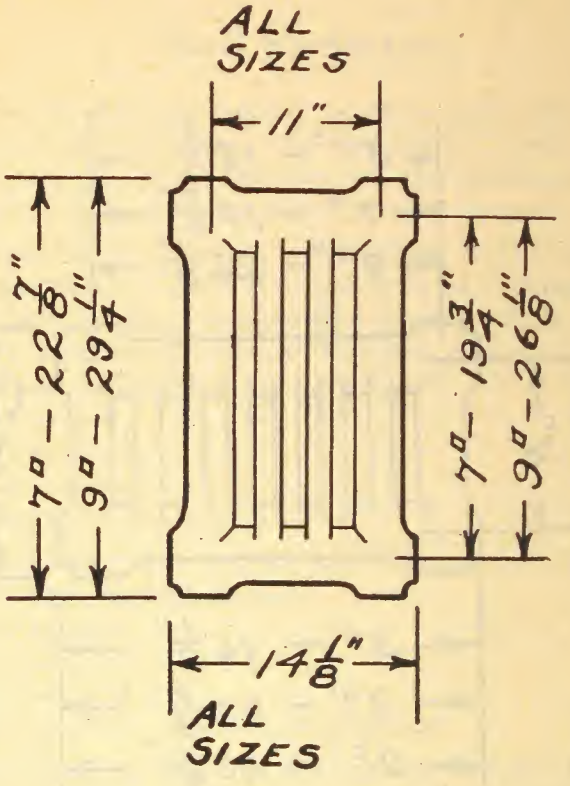
When assembled as per figure 2—5 sections and over.
When assembled as per figure 8—3 sections and over.

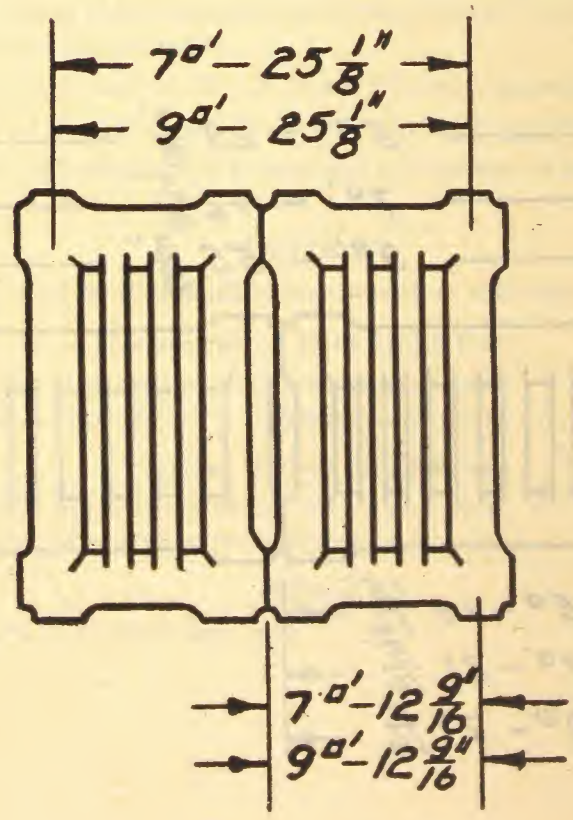
5 Foot

All assembling of 4 sections and over.



Above measurements apply to A or B styles. See note on tappings page 154.





Above measurements apply to A or B styles. See note on tappings page 154.

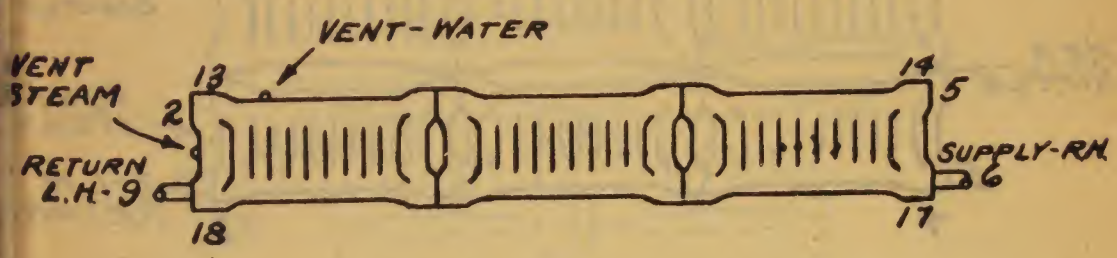


Fig. 1. Assembled in single tier. Water or one and two pipe steam.

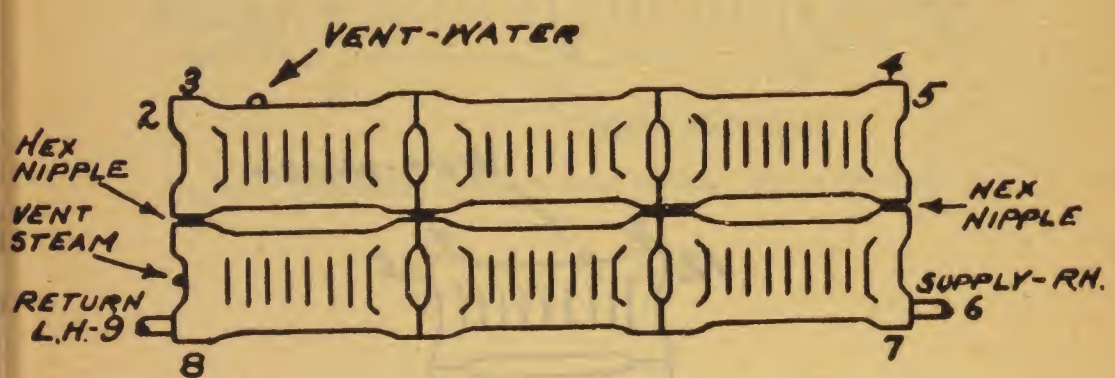


Fig. 3. Assembled in two or more tiers. Water or steam.

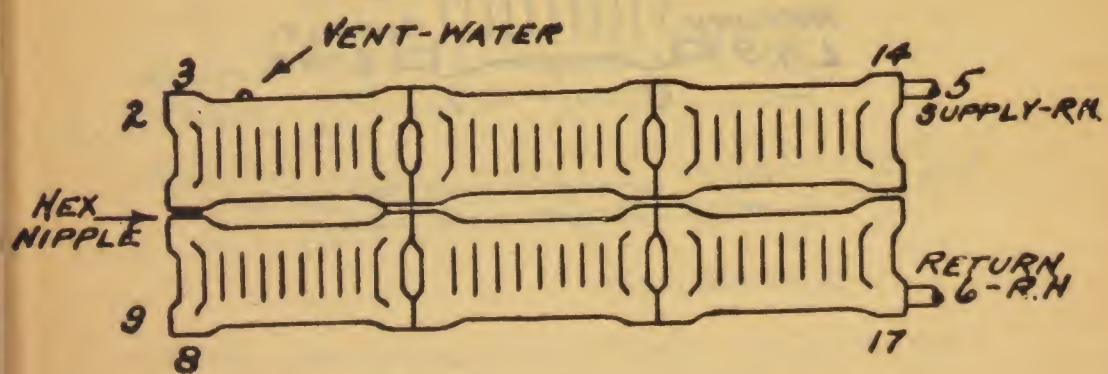


Fig. 5. Assembled in two tiers. Water only.

See note on tappings page 154.

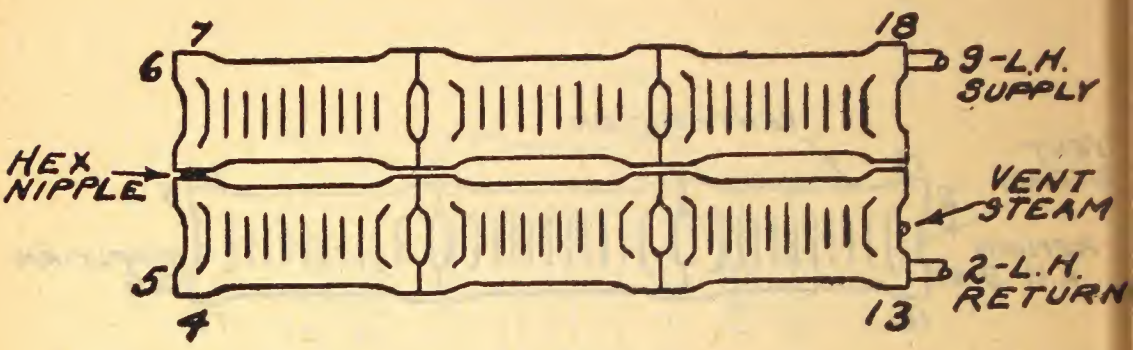


Fig. 7. Assembled in two tiers. Two pipe steam only.

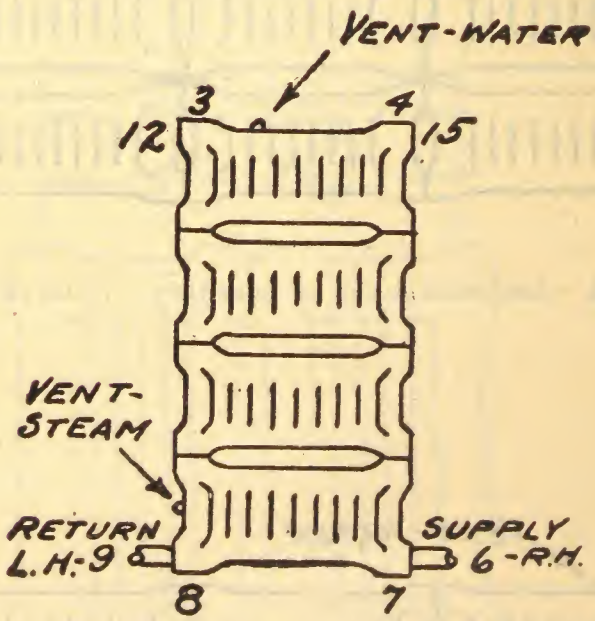


Fig. 9. Assembled in single stack.
Water or one and two pipe steam.

See note on tappings page 154.

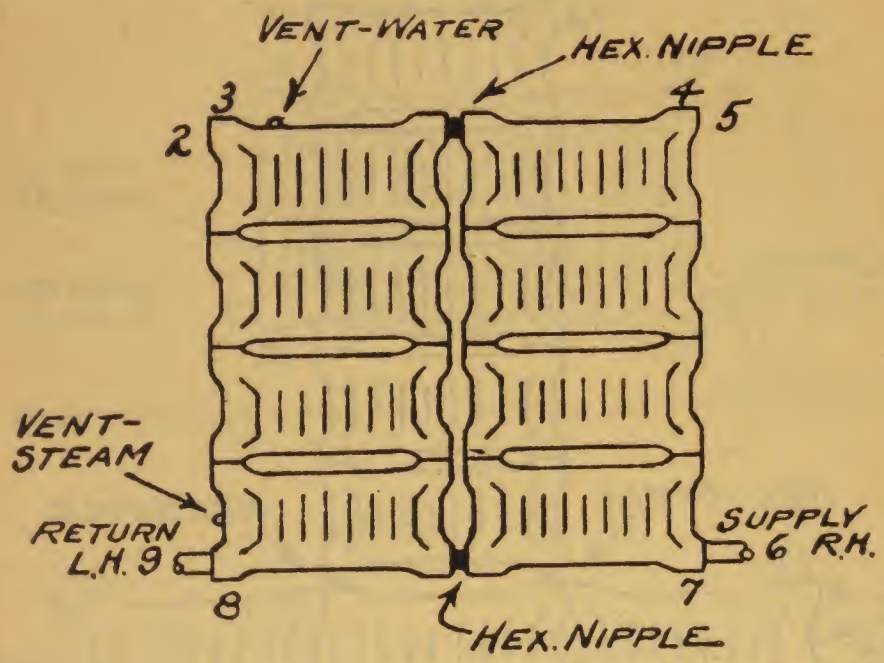


Fig. 11. Assembled in two or more stacks. Water or steam.

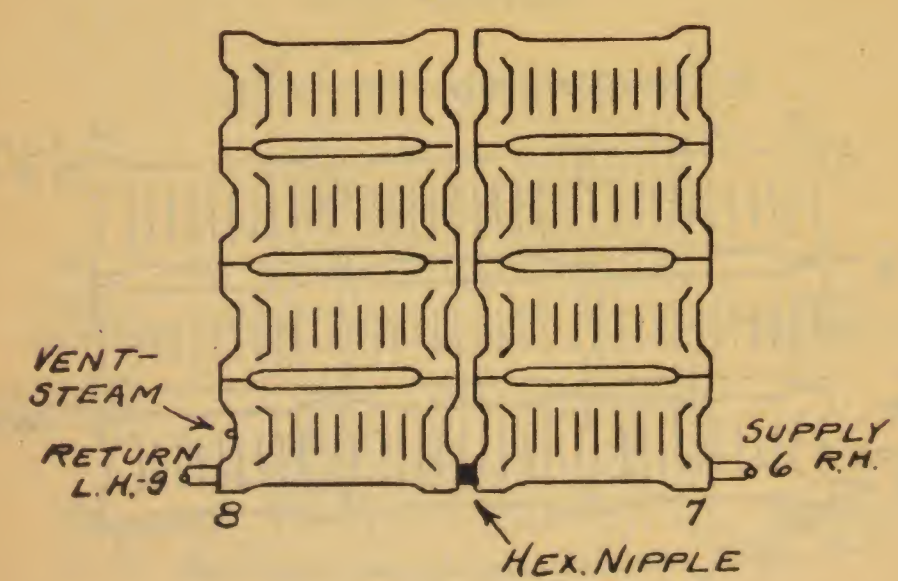


Fig. 13. Assembled in two or more stacks. One and two pipe steam only. Bottom feed only.

See note on tappings page 154.

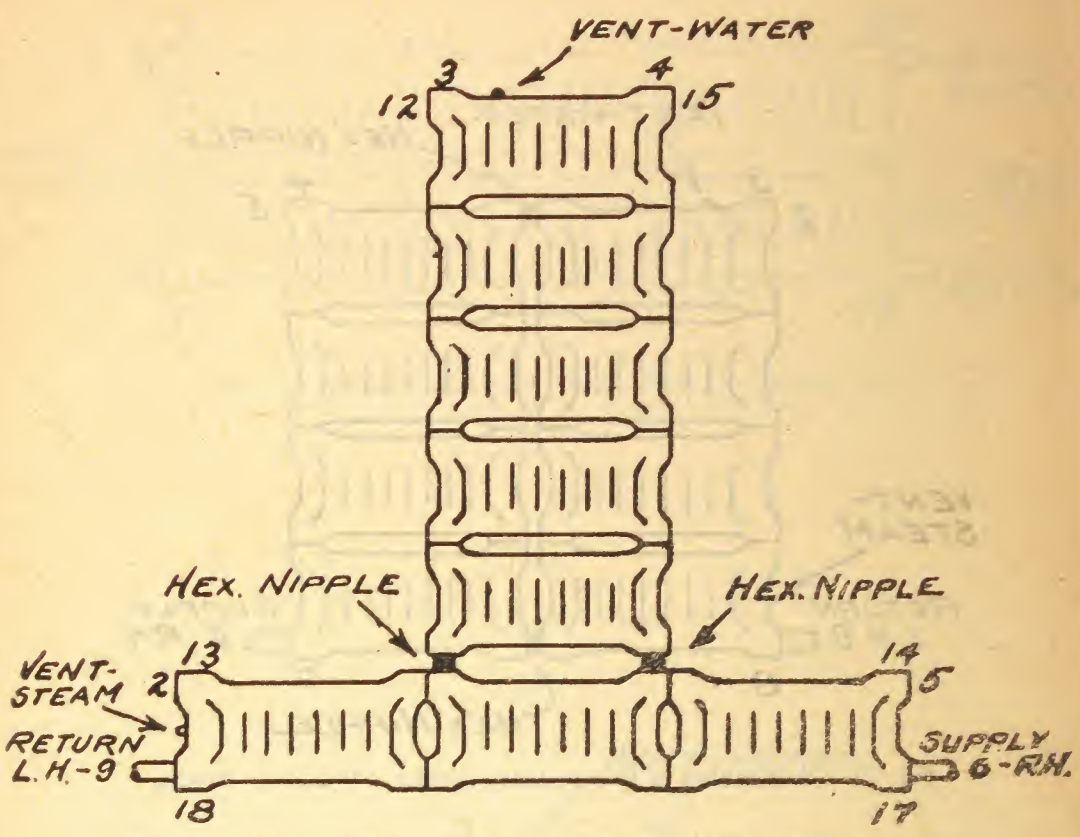


Fig. 15. Assembled in single tier and single stack. Water or one or two pipe steam.

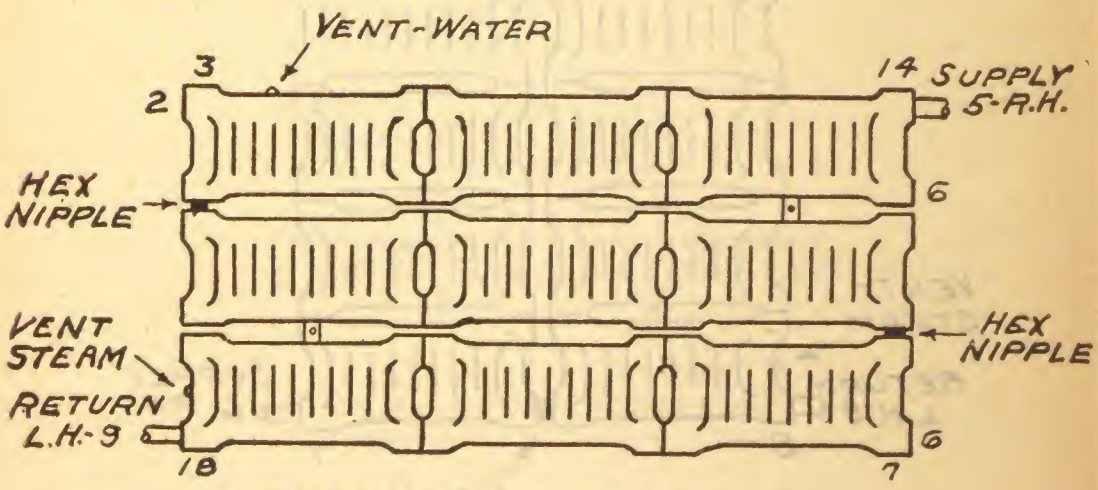


Fig. 17. Assembled nine sections in three tiers—using adjustable spacing saddle

See note on tappings page 154.

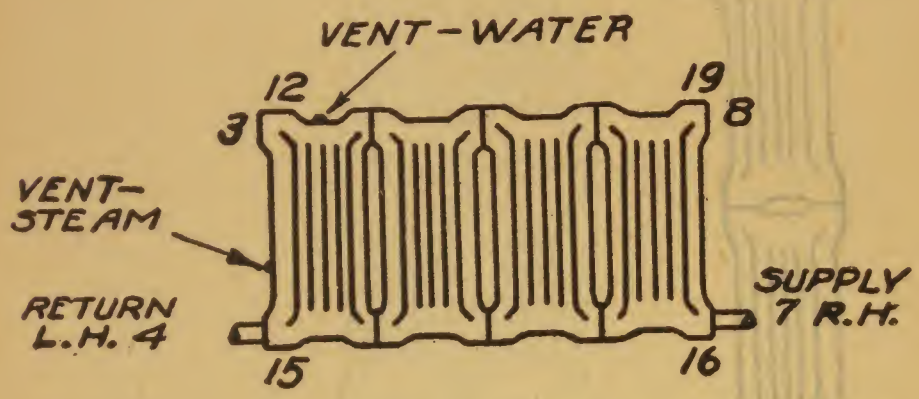


Fig. 2. Assembled in single tier. For water, one or two pipe steam.

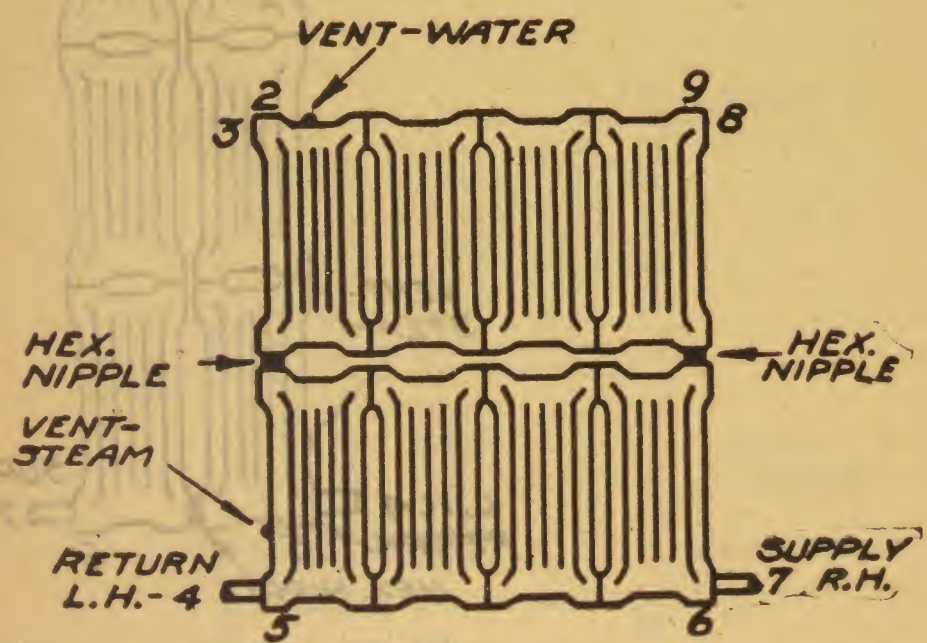


Fig. 6. Assembled in two or more tiers. Water or steam.

See note on tappings page 154.

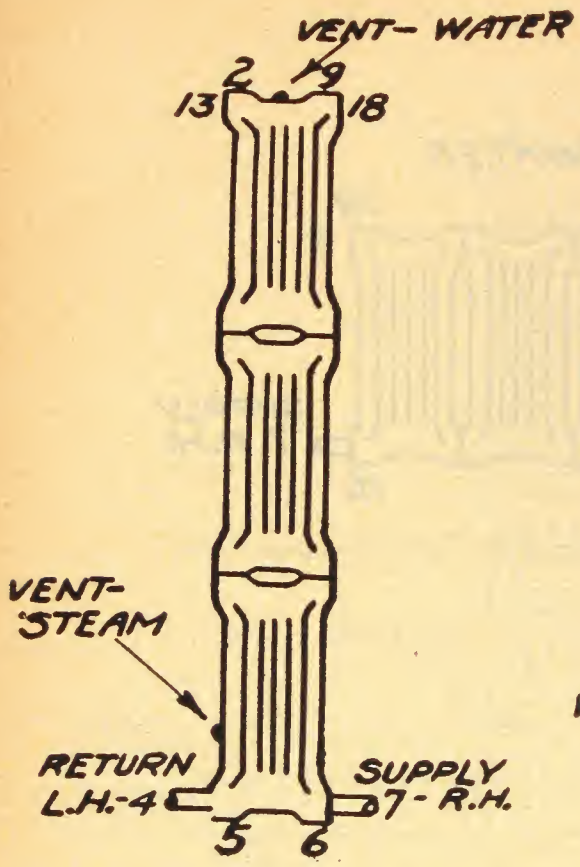


Fig. 8. Assembled in single stack. Water or one and two pipe steam.

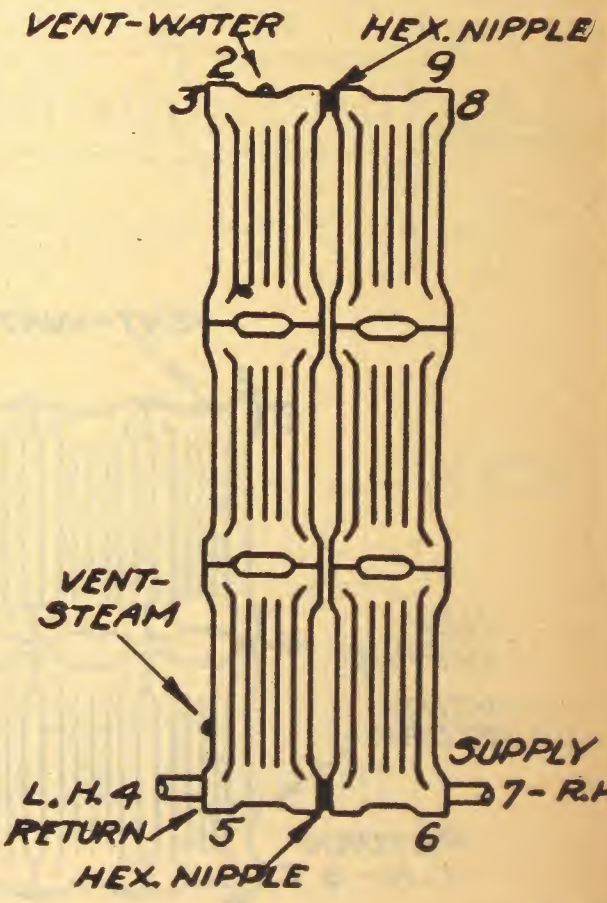


Fig. 10. Assembled in two or more stacks. Water or steam.

See note on tappings page 154

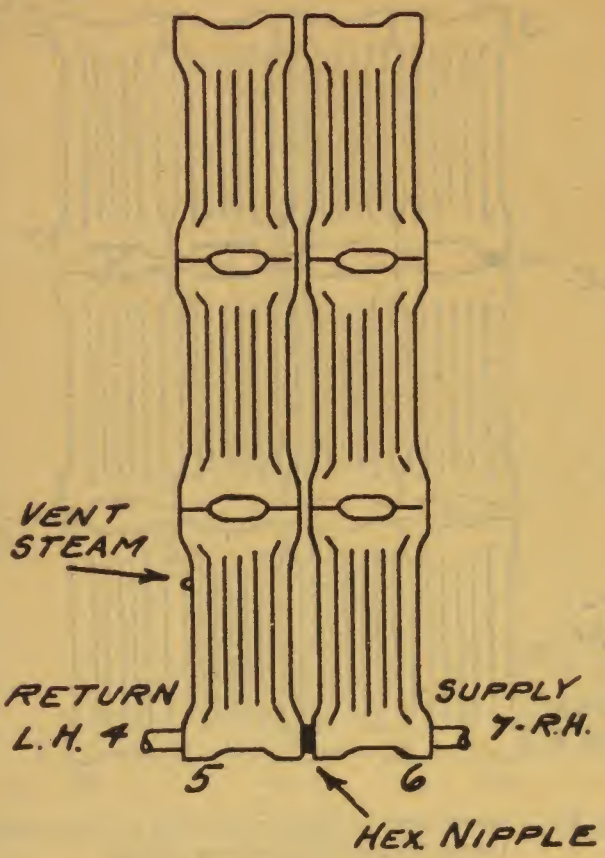


Fig. 12. Assembled in two or more stacks. One and two pipe steam only. Bottom feed only.

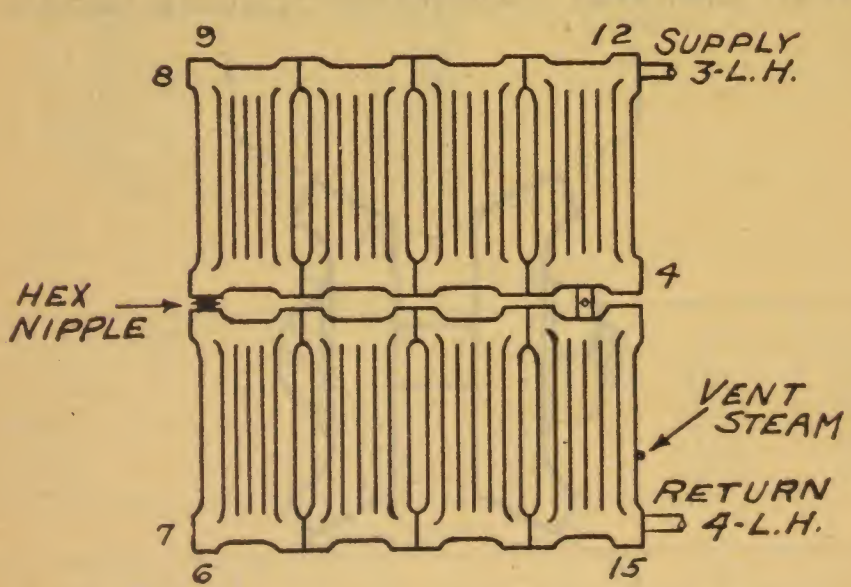


Fig. 16. Assembled in eight sections in two tiers. For two pipe steam using adjustable spacing saddle.

See note on tappings page 154.

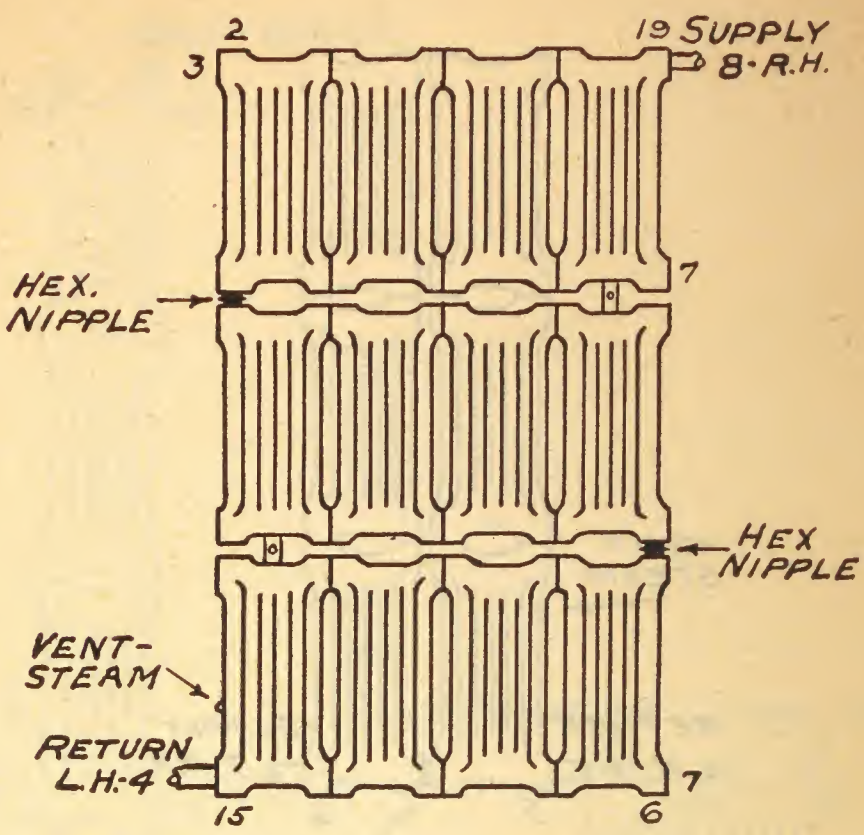
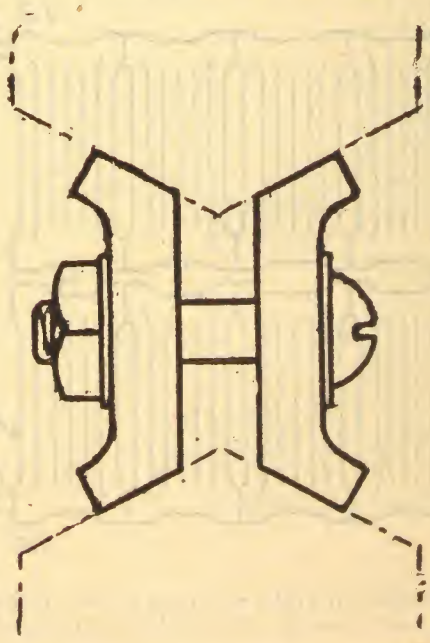


Fig. 18. Assembled in twelve sections in three tiers. Using adjustable spacing saddle.

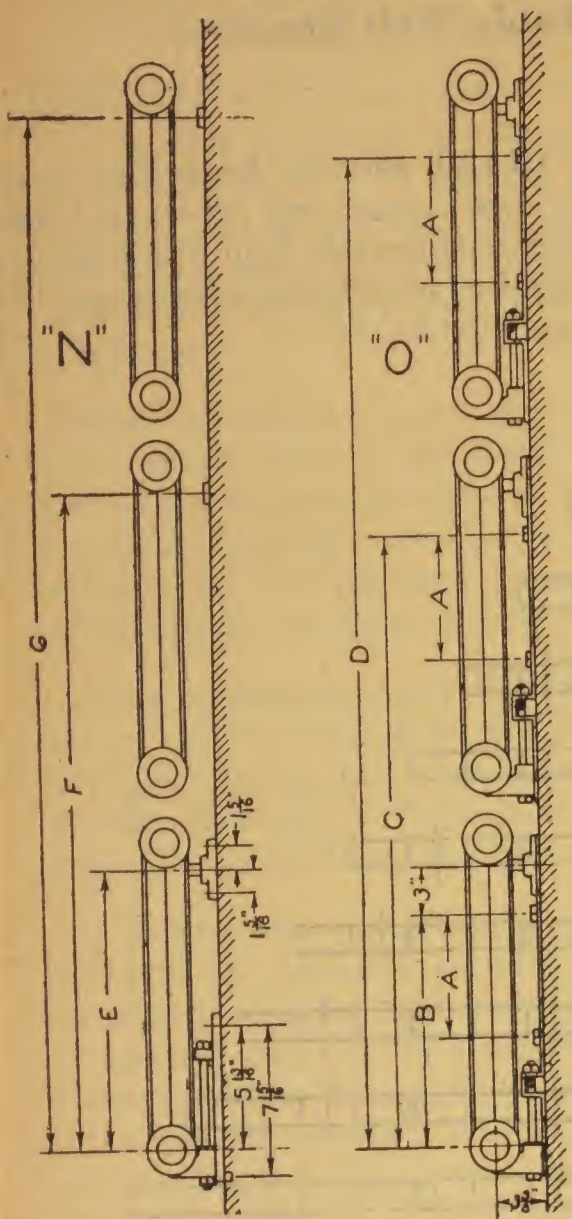
See note on tappings page 154.

Wall Radiator Adjustable Spacing Saddle

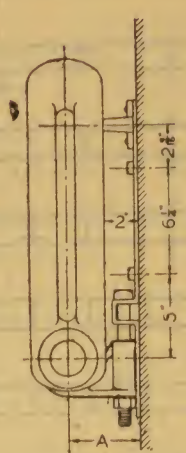


Furnished between sections in assemblages of Triton Wall Radiators
See Figures 17, 16 and 18 on pages 160, 163, 164.

Triton Adjustable Brackets



N Wall O Wall



Column

Dimension A

1 Column . . . . . 4 1/4"
2 Column . . . . . 5 1/2"
3 Column . . . . . 6 1/2"
4 Column . . . . . 8 1/4"

Dimension "O"

Kind of Section	A	B	C	D
All Horizontal	0	6 15/16"	20 13/16"	34 11/16"
9′ Vertical	8 1/16"	15"	44 1/4"	73 1/2"
7′ Vertical	8 1/16"	15"	37 7/8"	60 3/4"
5′ Vertical	8 1/16"	15"	31 1/2"	48"

Dimensions "N"

Kind of Section	E	F	G
All Horizontal	9 1/2"	23 3/8"	37 1/4"
9′ Vertical	24 3/8"	53 5/8"	82 7/8"
7′ Vertical	18"	40 7/8"	63 3/4"
5′ Vertical	11 5/8"	28 1/8"	44 5/8"

Adjustment one inch either way from position shown.

Triton Adjustable Wall Brackets

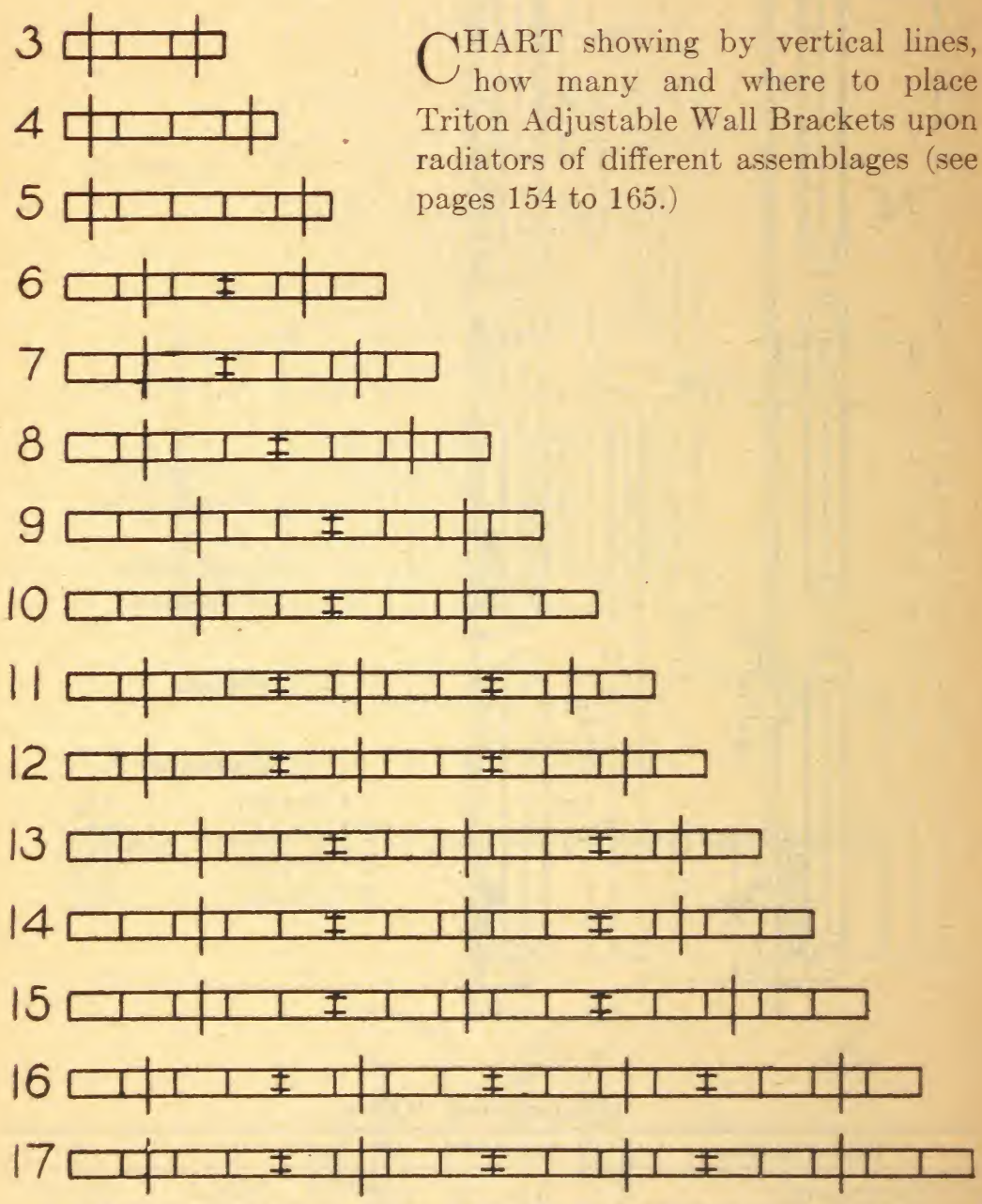


CHART showing by vertical lines, how many and where to place Triton Adjustable Wall Brackets upon radiators of different assemblages (see pages 154 to 165.)

For longer assemblage combine the above figures as follows:

18.....10+8	22.....12+10	27.....12+15
19.....10+9	23.....10+13	28.....15+13
20.....10+10	24.....15+9	29.....15+14
21.....12+9	25.....15+10	30.....15+15
	26.....12+14	

Proportioning Radiation

For Steam and Water Heating

BECAUSE of different conditions surrounding the installation of a heating apparatus, it is impossible to give any set rule that can be accepted, without modification, for all kinds of buildings to be heated. It is necessary to take into consideration all of the conditions in and around any building, and additions or deductions made to suit the requirements, no matter what rule may be used for figuring.

Nearly all rules are based on two to five pounds steam pressure and a temperature of 180 degrees for water, as indicated at the boiler when the outside temperature is at zero. When systems are designed for heating with a lower temperature at the boiler (vapor, vacuum, etc.) it is necessary to provide additional radiation in accordance with best practice for different systems.

Many contractors make the error of installing too little radiation. A little extra surface will give greater economy and insure a first-class working system, as well as a pleased owner. An apparatus of ample size can be regulated to give economy, which cannot be done if the apparatus is too small and requires forcing.

If *direct-indirect* radiation is to be used, *25 per cent* should be added to the radiation necessary for direct heating. If indirect radiation is to be used, 50 per cent should be added to the amount of radiation necessary for direct heating. In schools, churches, etc., where ventilation is required, it is necessary to use some special rule for ventilating to obtain indirect surface. (Before determining the size of boiler required, all special forms of heating surface should be made the equivalent of direct radiation as shown on page 189.)

The amount of radiation computed for steam should be multiplied by 1.65 to determine the quantity of water radiation required.

The following rules have been found to give good results, but are not guaranteed. By using these rules and providing for additional radiation on the cold sides of building and making allowance for poor construction, loose-fitting windows, doors, etc., good results will be obtained.

Proportioning Radiation—Continued

Double 1-inch board, 4-inches sawdust between	26 W
Double 1-inch board, 6 inches sawdust between	17 W
Plain wood wall ¾-inch	200 W
Plain wood wall 1-inch	170 W
Plain wood wall 2-inch	125 W
Plain wood wall 4-inch	85 W
Double pine boards, paper between ½-inch boards	95 W
Double pine boards, paper between 1-inch boards	70 W
Double pine boards, paper between 2-inch boards	45 W
Channel iron partition, wire lath, plaster both sides	100 W
Channel iron partition, asbestos filling	60 W
Corrugated iron with ½-inch tongue and groove board	130 W
Corrugated iron with 1-inch tongue and groove board	105 W
Corrugated iron with 2-inch tongue and groove board	75 W
Unlined corrugated iron	430 W
Unlined sheet iron	350 W
Sheet iron on ½-inch pine facing	145 W
Sheet iron on 1-inch pine facing	115 W
Sheet iron on 2-inch pine facing	80 W

Solid cement and concrete block when plastered directly on wall should be figured same as 8-inch brick. Same, with space between wall and plaster, as 12-inch brick. Brick veneer same as 12-inch brick.

Glass

Double windows	140 G
Skylights, same as windows, double or single.	
Plate glass	250 G
Monitor windows, single glass	310 G

Roofs and Floors

Tin or copper roof on 1-inch boards	130 W
Shingle roof	95 W
Dirt floor	60 W
Concrete or cement on dirt	90 W
Wood on cement floor	35 W

Churches and Auditoriums

Multiply radiation found by rule by factors below for buildings of large cubic content.

Contents in Cubic Feet	Factor
30,000 to 50,000	.9
50,000 to 70,000	.85
70,000 to 90,000	.8
90,000 to 110,000	.75
Over 110,000	.7

Proportioning Radiation—Continued

For Garages and other buildings, having a large number of air changes per hour, additional radiation should be provided.

Rule No. 2

Professor R. C. Carpenter, of Cornell University, submits the following rule for determining the size radiator needed for a given room:

RULE.—Add the area of the glass surface in the room to one-quarter of the exposed wall surface, and to this add from 1/55 to 3/55 of the cubical contents (1/55 for rooms on upper floors, 2/55 for rooms on first floor and 3/55 for large halls); then for steam multiply by .25 and for hot water by .40.

EXAMPLE.—A room 20×12×10 feet with glass exposure of 48 feet, one-quarter of wall exposure (two sides exposed) 320 feet = 80, 1/55 of 2400 = 44.

48 + 80 + 44 = 172 × .25 = 43 feet for steam.
If you add 2/55 the surface would be 54 feet.
If you add 3/55 the surface would be 65 feet.

Corrections should be made as in Rule No. 1.

Usual Inside Temperatures Specified

Public Buildings	68°-72° F.
Factories	65° F.
Machine Shops	60°-65° F.
Foundries, Boiler Shops, etc	50°-60° F.
Residences	70° F.
Bath Rooms	85° F.
Schools	70° F.
Hospitals	72°-75° F.
Paint Shops	80° F.

Cubical Contents of Rooms

Ceiling 8½ Feet High

Examples: Cubical contents of room 10 x 14 x 8½ = 1190 cu. ft.
Cubical contents of large rooms such as 22½ x 24 x 8½ = cubical contents of two rooms 10½ x 24 x 8½ and 12 x 24 x 8½ = 2142 + 2448 = 4590 cu. ft.

8½ FT. CEILING

WIDTH \ LENGTH	4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10	10½	11	11½	12	12½	13	13½	14	14½	15	16	17	18	19	20	21	22	23	24	25
4	136	153	170	187	204	221	238	255	272	289	306	323	340	357	374	391	408	425	442	459	476	493	510	544	578	612	646	680	714	748	782	816	850
4½	153	172	191	210	230	249	268	287	306	325	345	363	382	402	421	440	459	478	497	516	536	555	574	612	650	689	727	765	803	842	880	918	956
5	170	191	212	234	255	276	298	319	340	361	383	404	425	446	468	489	510	531	553	574	595	616	638	680	722	765	807	850	893	935	978	1020	1063
5½	187	210	234	257	281	304	327	351	374	397	421	444	468	491	514	538	561	584	608	631	655	678	701	748	795	842	888	935	982	1029	1075	1122	1169
6	204	230	255	281	306	332	357	383	408	434	459	485	510	536	561	587	613	638	663	689	714	740	765	816	867	918	969	1020	1071	1122	1173	1224	1275
6½	221	249	276	304	332	359	387	414	442	470	497	525	553	580	608	635	662	691	718	746	774	801	829	884	939	995	1050	1105	1160	1216	1271	1326	1381
7	238	268	298	327	357	387	417	446	476	506	536	565	595	625	655	684	714	744	774	803	833	863	893	952	1012	1071	1131	1190	1250	1309	1369	1428	1488
7½	255	287	319	351	383	414	446	478	510	542	574	606	638	669	701	733	765	797	829	861	893	924	956	1020	1084	1148	1211	1275	1339	1403	1466	1530	1594
8	272	306	340	374	408	442	476	510	544	578	612	646	680	714	748	782	816	850	884	918	952	986	1020	1088	1156	1224	1292	1360	1428	1496	1564	1632	1700
8½	289	325	361	397	434	470	506	542	578	614	650	686	723	759	795	831	867	903	939	975	1012	1048	1084	1156	1228	1301	1373	1445	1517	1590	1662	1734	1806
9	306	345	383	421	459	497	536	574	612	650	689	727	765	803	842	880	918	956	995	1033	1071	1109	1148	1224	1301	1377	1454	1530	1607	1683	1760	1836	1913
9½	323	363	404	444	485	525	565	606	646	686	727	767	808	848	888	929	969	1009	1050	1090	1131	1171	1211	1292	1373	1454	1534	1615	1696	1777	1857	1938	2019
10	340	382	425	468	510	553	595	638	680	723	765	808	850	893	935	978	1020	1063	1105	1148	1190	1233	1275	1360	1445	1530	1615	1700	1785	1870	1955	2040	2125
10½	357	402	446	491	536	580	625	669	714	759	803	848	893	937	982	1026	1071	1116	1160	1205	1250	1294	1339	1428	1517	1607	1696	1785	1874	1964	2053	2142	2231
11	374	421	468	514	561	608	655	701	748	795	842	888	935	982	1029	1075	1122	1169	1216	1262	1309	1356	1403	1496	1590	1683	1777	1870	1964	2057	2151	2244	2338
11½	391	440	489	538	587	635	684	733	782	831	880	929	978	1026	1075	1124	1173	1222	1271	1320	1369	1418	1466	1564	1662	1760	1857	1955	2053	2151	2248	2346	2444
12	408	459	510	561	612	663	714	765	816	867	918	969	1020	1071	1122	1173	1224	1275	1326	1377	1428	1479	1530	1632	1734	1836	1938	2040	2142	2244	2346	2448	2550
13	442	497	553	608	663	718	774	829	884	939	995	1050	1105	1160	1216	1271	1326	1381	1437	1492	1547	1602	1658	1768	1879	1989	2100	2210	2321	2431	2542	2652	2763
14	476	536	595	655	714	774	833	893	952	1012	1071	1131	1190	1250	1309	1369	1428	1488	1547	1607	1666	1726	1785	1904	2023	2142	2261	2380	2499	2618	2737	2856	2975
15	510	574	638	701	765	829	893	956	1020	1084	1148	1211	1275	1339	1403	1466	1530	1594	1658	1721	1785	1849	1913	2040	2168	2295	2423	2550	2678	2805	2933	3060	3188
WIDTH \ LENGTH	4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10	10½	11	11½	12	12½	13	13½	14	14½	15	16	17	18	19	20	21	22	23	24	25

Cubical Contents of Rooms—Continued

Ceiling 9 Feet High

Example: Cubical contents of room 10 x 14 x 9 = 1260 cu. ft.
Cubical contents of large rooms such as 17½ x 20 x 9 = cubical contents of two rooms 8½ x 20 x 9 and 9 x 20 x 9 = 1530 + 1620 = 3150 cu. ft.

WIDTH \ LENGTH	4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10	10½	11	11½	12	12½	13	13½	14	14½	15	16	17	18	19	20	21	22	23	24	25
4	144	162	180	198	216	234	252	270	288	306	324	342	360	378	396	414	432	450	468	486	504	522	540	576	612	648	684	720	756	792	828	864	900
4½	162	182	203	223	243	263	284	304	324	344	365	385	405	425	446	466	486	506	527	547	567	587	608	648	689	729	770	810	851	891	932	972	1013
5	180	203	225	248	270	293	315	338	360	383	405	428	450	473	495	518	540	563	585	608	630	653	675	720	765	810	855	900	945	990	1035	1080	1125
5½	198	223	248	272	297	322	347	371	396	421	446	470	495	520	545	569	594	619	644	668	693	718	743	792	842	891	941	990	1040	1089	1139	1188	1238
6	216	243	270	297	324	351	378	405	432	459	486	513	540	567	594	621	648	675	702	729	756	783	810	864	918	972	1026	1080	1134	1188	1242	1296	1350
6½	234	263	293	322	351	380	410	439	468	497	527	556	585	614	644	673	702	731	761	790	819	848	878	936	995	1053	1112	1170	1229	1287	1346	1404	1463
7	252	284	315	347	378	410	441	473	504	536	567	599	630	662	693	725	756	788	819	851	882	914	945	1008	1071	1134	1197	1260	1323	1386	1449	1512	1575
7½	270	304	338	371	405	439	473	506	540	574	608	641	675	709	743	776	810	844	878	911	945	979	1013	1080	1148	1215	1283	1350	1418	1485	1553	1620	1688
8	288	324	360	396	432	468	504	540	576	612	648	684	720	756	792	828	864	900	936	972	1008	1044	1080	1152	1224	1296	1368	1440	1512	1584	1656	1728	1800
8½	306	344	383	421	459	497	536	574	612	650	689	727	765	803	842	880	918	956	995	1033	1071	1109	1148	1224	1301	1377	1454	1530	1607	1683	1760	1836	1913
9	324	365	405	446	486	527	567	608	648	689	729	770	810	851	891	932	972	1013	1053	1094	1134	1175	1215	1296	1377	1458	1539	1620	1701	1782	1863	1944	2025
9½	342	385	428	470	513	556	599	641	684	727	770	812	855	898	940	983	1026	1069	1111	1154	1197	1240	1282	1368	1453	1539	1625	1710	1796	1881	1967	2052	2138
10	360	405	450	495	540	585	630	675	720	765	810	855	900	945	990	1035	1080	1125	1170	1215	1260	1305	1350	1440	1530	1620	1710	1800	1890	1980	2070	2160	2250
10½	378	425	473	520	567	614	662	709	756	803	851	898	945	992	1040	1087	1134	1181	1229	1276	1323	1370	1418	1512	1607	1701	1796	1890	1985	2079	2174	2268	2363
11	396	446	495	545	594	644	693	743	792	842	891	940	990	1040	1089	1139	1188	1238	1287	1337	1386	1436	1485	1584	1683	1782	1881	1980	2079	2178	2277	2376	2475
11½	414	466	518	569	621	673	725	776	828	880	932	983	1035	1087	1139	1190	1242	1294	1346	1397	1449	1501	1553	1656	1760	1863	1967	2070	2174	2277	2381	2484	2588
12	432	486	540	594	648	702	756	810	864	918	972	1026	1080	1134	1188	1242	1296	1350	1404	1458	1512	1566	1620	1728	1836	1944	2052	2160	2268	2376	2484	2592	2700
13	468	527	585	644	702	761	819	882	936	995	1053	1111	1170	1229	1287	1346	1404	1463	1521	1580	1638	1697	1755	1872	1989	2106	2223	2340	2457	2574	2691	2808	2925
14	504	567	630	693	756	819	882	945	1008	1071	1134	1197	1260	1323	1386	1449	1512	1575	1638	1701	1764	1827	1890	2016	2142	2268	2394	2520	2646	2772	2898	3024	3150
15	540	608	675	743	810	878	945	1013	1080	1148	1215	1282	1350	1418	1485	1553	1620	1688	1755	1823	1890	1958	2025	2160	2295	2430	2565	2700	2835	2970	3105	3240	3375
	4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10	10½	11	11½	12	12½	13	13½	14	14½	15	16	17	18	19	20	21	22	23	24	25

Cubical Contents of Rooms—Continued

Ceiling 9½ Feet High

Example: Cubical contents of room 8 x 14½ x 9½ = 1102 cu. ft.
Cubical contents of large rooms such as 25 x 24 x 9½ = cubical contents of two rooms 15 x 24 x 9½ and 10 x 24 x 9½ = 3420 + 2280 = 5700 cu. ft.

WIDTH \ LENGTH	4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10	10½	11	11½	12	12½	13	13½	14	14½	15	16	17	18	19	20	21	22	23	24	25
4	152	171	190	209	228	247	266	285	304	323	342	361	380	399	418	437	456	475	494	513	532	551	570	608	646	684	722	760	798	836	874	912	950
4½	171	192	213	235	256	277	299	320	342	363	384	406	427	448	470	491	513	534	555	577	598	619	641	684	726	769	812	855	897	940	983	1026	1069
5	190	213	237	261	285	308	332	356	380	403	427	451	475	498	522	547	570	593	617	641	665	688	712	760	807	855	902	950	997	1045	1092	1140	1187
5½	209	235	261	287	313	339	365	391	418	444	470	496	522	548	574	600	627	653	679	705	731	757	783	836	888	940	993	1045	1097	1149	1201	1254	1306
6	228	256	285	313	342	370	399	427	456	484	513	541	570	598	627	655	684	712	741	769	798	826	855	912	969	1026	1083	1140	1197	1254	1311	1368	1425
6½	247	277	308	339	370	401	432	463	494	524	555	586	617	648	679	710	741	771	802	833	864	895	926	988	1049	1111	1173	1235	1296	1358	1420	1482	1543
7	266	299	332	365	399	432	465	498	532	565	598	631	665	698	731	764	798	831	864	897	931	964	997	1064	1130	1197	1263	1330	1396	1463	1529	1596	1662
7½	285	320	356	391	427	463	498	534	570	605	641	676	712	748	783	819	855	890	926	961	997	1033	1068	1140	1211	1282	1353	1425	1496	1567	1638	1710	1781
8	304	342	380	418	456	494	532	570	608	646	684	722	760	798	836	874	912	950	988	1026	1064	1102	1140	1216	1292	1368	1444	1520	1596	1672	1748	1824	1900
8½	323	363	403	444	484	524	565	605	646	686	726	767	807	847	888	928	969	1009	1049	1090	1130	1170	1211	1292	1372	1453	1534	1615	1695	1776	1857	1938	2018
9	342	384	427	470	513	555	598	641	684	726	767	812	855	897	940	982	1026	1068	1111	1154	1197	1239	1282	1368	1453	1539	1624	1710	1795	1881	1967	2052	2137
9½	361	406	451	496	541	586	631	676	722	767	812	857	902	947	992	1038	1083	1128	1173	1218	1263	1308	1353	1444	1534	1624	1714	1805	1895	1985	2075	2166	2256
10	380	427	475	522	570	617	665	712	760	807	855	902	950	997	1045	1092	1140	1187	1235	1282	1330	1377	1425	1520	1615	1710	1805	1900	1995	2090	2185	2280	2375
10½	399	448	498	548	598	648	698	748	798	847	897	947	997	1047	1097	1147	1197	1246	1296	1346	1396	1446	1496	1596	1695	1795	1895	1995	2094	2194	2294	2394	2493
11	418	470	522	574	627	679	731	783	836	888	940	992	1045	1097	1149	1201	1254	1306	1358	1410	1463	1515	1567	1672	1776	1881	1986	2090	2194	2299	2403	2508	2612
11½	437	491	547	600	655	710	764	819	874	928	982	1038	1092	1147	1201	1256	1311	1365	1420	1474	1529	1584	1638	1748	1857	1966	2075	2185	2295	2403	2512	2622	2731
12	456	513	570	627	684	741	798	855	912	969	1026	1083	1140	1197	1254	1311	1368	1425	1482	1539	1596	1653	1710	1824	1938	2052	2166	2280	2394	2507	2622	2736	2850
13	494	555	617	679	741	802	864	926	988	1049	1111	1173	1235	1296	1358	1420	1482	1543	1605	1667	1729	1790	1852	1976	2099	2223	2346	2470	2593	2717	2840	2964	3087
14	532	598	665	731	798	864	931	997	1064	1130	1197	1263	1330	1396	1463	1529	1596	1663	1729	1795	1862	1928	1995	2128	2261	2394	2527	2660	2793	2926	3059	3192	3325
15	570	641	712	783	855	926	997	1068	1140	1211	1282	1353	1425	1496	1567	1638	1710	1781	1852	1923	1995	2066	2137	2280	2422	2565	2707	2850	2992	3135	3277	3420	3652
	4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10	10½	11	11½	12	12½	13	13½	14	14½	15	16	17	18	19	20	21	22	23	24	25

Cubical Contents of Rooms—Continued

Ceiling 10 Feet High

Examples: Cubical contents of room 10½ x 12½ x 10 = 1313 cu. ft.
Cubical contents of large rooms such as 17½ x 20 x 10 = cubical contents of two rooms 10 x 20 x 10 and 7½ x 20 x 10 = 2000 + 1500 = 3500 cu. ft.

10 FT. CEILING

WIDTH \ LENGTH	4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10	10½	11	11½	12	12½	13	13½	14	14½	15	16	17	18	19	20	21	22	23	24	25
4	160	180	200	220	240	260	280	300	320	340	360	380	400	420	440	460	480	500	520	540	560	580	600	640	680	720	760	800	840	880	920	960	1000
4½	180	203	225	248	270	293	315	338	360	383	405	428	450	473	495	518	540	563	585	608	630	653	675	720	765	810	855	900	945	990	1035	1080	1125
5	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550	575	600	625	650	675	700	725	750	800	850	900	950	1000	1050	1100	1150	1200	1250
5½	220	248	275	303	330	358	385	413	440	468	495	523	550	578	605	633	660	688	715	743	770	798	825	880	935	990	1045	1100	1155	1210	1265	1320	1375
6	240	270	300	330	360	390	420	450	480	510	540	570	600	630	660	690	720	750	780	810	840	870	900	960	1020	1080	1140	1200	1260	1320	1380	1440	1500
6½	260	293	325	358	390	423	455	488	520	553	585	618	650	683	715	748	780	813	845	878	910	943	975	1040	1105	1170	1235	1300	1365	1430	1495	1560	1625
7	280	315	350	385	420	455	490	525	560	595	630	665	700	735	770	805	840	875	910	945	980	1015	1050	1120	1190	1260	1330	1400	1470	1540	1610	1680	1750
7½	300	338	375	413	450	488	525	563	600	638	675	713	750	788	825	863	900	938	975	1013	1050	1088	1125	1200	1275	1350	1425	1500	1575	1650	1725	1800	1875
8	320	360	400	440	480	520	560	600	640	680	720	760	800	840	880	920	960	1000	1040	1080	1120	1160	1200	1280	1360	1440	1520	1600	1680	1760	1840	1920	2000
8½	340	383	425	468	510	563	595	638	680	723	765	808	850	893	935	978	1020	1063	1105	1148	1190	1233	1275	1360	1445	1530	1615	1700	1785	1870	1955	2040	2125
9	360	405	450	495	540	585	630	675	720	765	810	855	900	945	990	1035	1080	1125	1170	1215	1260	1305	1350	1440	1530	1620	1710	1800	1890	1980	2070	2160	2250
9½	380	428	475	523	570	618	665	713	760	808	855	903	950	998	1045	1193	1140	1188	1235	1283	1330	1378	1425	1520	1615	1710	1805	1900	1995	2090	2185	2280	2375
10	400	450	500	550	600	650	700	750	800	850	900	950	1000	1050	1100	1150	1200	1250	1300	1350	1400	1450	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500
10½	420	473	525	578	630	683	735	788	840	893	945	998	1050	1103	1155	1208	1260	1313	1365	1418	1470	1523	1575	1680	1785	1890	1995	2100	2205	2310	2415	2520	2625
11	440	495	550	605	660	715	770	825	880	935	990	1045	1100	1155	1210	1265	1320	1375	1430	1485	1540	1595	1650	1760	1870	1980	2090	2200	2310	2420	2530	2640	2750
11½	460	518	575	633	690	748	805	863	920	978	1035	1093	1150	1208	1265	1323	1380	1438	1495	1553	1610	1668	1725	1840	1955	2070	2185	2300	2415	2530	2645	2760	2875
12	480	540	600	660	720	780	840	900	960	1020	1080	1140	1200	1260	1320	1380	1440	1500	1560	1620	1680	1740	1800	1920	2040	2160	2280	2400	2520	2640	2760	2880	3000
13	520	585	650	715	780	845	910	975	1040	1105	1170	1235	1300	1365	1430	1495	1560	1625	1690	1755	1820	1885	1950	2080	2210	2340	2470	2600	2730	2860	2990	3120	3250
14	560	630	700	770	840	910	980	1050	1120	1190	1260	1330	1400	1470	1540	1610	1680	1750	1820	1890	1960	2030	2100	2240	2380	2520	2660	2800	2940	3080	3220	3360	3500
15	600	675	750	825	900	975	1050	1125	1200	1275	1350	1425	1500	1575	1650	1725	1800	1875	1950	2025	2100	2175	2250	2400	2550	2700	2850	3000	3150	3300	3450	3600	3750
	4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10	10½	11	11½	12	12½	13	13½	14	14½	15	16	17	18	19	20	21	22	23	24	25

Square Feet of Wall Surface

Running Feet of Wall	CEILING HEIGHTS—Feet											
	8	8½	9	9½	10	10½	11	11½	12	13	14	15
6	48	51	54	57	60	63	66	69	72	78	84	90
6½	52	55	59	62	65	68	72	75	78	85	91	98
7	56	60	63	67	70	74	77	81	84	91	98	105
7½	60	64	68	72	75	79	83	86	90	98	105	113
8	64	68	72	76	80	84	88	92	96	104	112	120
8½	68	72	77	81	85	89	94	98	102	111	119	128
9	72	76	81	86	90	94	99	104	108	117	126	135
9½	76	81	86	90	95	100	105	109	114	124	133	143
10	80	85	90	95	100	105	110	115	120	130	140	150
10½	84	89	95	100	105	110	116	121	126	137	147	158
11	88	94	99	105	110	116	121	127	132	143	154	165
11½	92	98	104	109	115	121	127	132	138	150	161	173
12	96	102	108	114	120	126	132	138	144	156	168	180
12½	100	106	113	119	125	131	138	144	150	163	175	188
13	104	111	117	123	130	137	143	150	156	169	182	195
13½	108	115	122	129	135	142	149	155	162	176	189	203
14	112	119	126	133	140	147	154	161	168	182	196	210
14½	116	123	131	138	145	152	160	167	174	189	203	218
15	120	128	135	143	150	158	165	173	180	195	210	225
15½	124	132	140	147	155	163	171	178	186	202	217	233
16	128	136	144	152	160	168	176	184	192	208	224	240
16½	132	140	149	157	165	173	182	190	198	215	231	248
17	136	145	153	162	170	179	187	196	204	221	238	255
17½	140	149	158	166	175	184	193	201	210	228	245	263
18	144	153	162	171	180	189	198	207	216	234	252	270
19	152	162	171	181	190	200	209	219	228	247	266	285
20	160	170	180	190	200	210	220	230	240	260	280	300
21	168	179	189	200	210	221	231	242	252	273	294	315
22	176	187	198	209	220	231	242	253	264	286	308	330
23	184	196	207	218	230	242	253	264	276	299	322	345
24	192	204	216	228	240	252	264	276	288	312	336	360
25	200	213	225	238	250	263	275	288	300	325	350	375
26	208	221	234	247	260	273	286	299	312	338	364	390
27	216	230	243	257	270	284	297	311	324	351	378	405
28	224	238	252	266	280	294	308	322	336	364	392	420
29	232	247	261	276	290	305	319	334	348	377	406	435
30	240	255	270	285	300	315	330	345	360	390	420	450
31	248	264	279	295	310	326	341	357	372	403	434	465
32	256	272	288	304	320	336	352	368	384	416	448	480

FULL AREA of TWO Pane Windows giving the total area including sash.
HEIGHT OF PANE
18"
22"
26"
30"
34"
38"
42"
46"
50"
54"
WIDTH OF PANE - INCHES.
60"
50"
40"
30"
20"
10"
AREA OF WINDOW - SQUARE FEET.
5
10
15
20
25
30
35
40
45
50

Comparisons of Heat Losses Through Different Commercial Insulating Materials

Test Material No.	NAME	Temperature Difference—Deg. Fahr.					Thickness		Weight per Lin. Ft.	Conditions for which recommended by Manufacturer
		100	200	300	400	500	Inches Actual	Inches Apparent		
		B.t.u. per sq. ft. of pipe surface per deg. Temp. dif. per hr.								
I	J-M 85% Magnesia	0.381	0.397	0.413	0.429	0.445	1.11	1.18	2.73	High Pressure Steam
II	J-M Indented	0.483	0.509	0.549	0.603	0.666		1.12	3.46	High Pressure Steam
III	J-M Vitribestos	0.654	0.715	0.781	0.858	0.967	0.96	1.11	4.05	Stack and breeching linings
IV	J-M Eureka	0.451	0.464	0.478				1.04	4.60	L. p. s. and h. w.
V	J-M Molded Asbestos	0.522	0.539	0.561	0.596		1.25	1.26	5.53	L. p. s. & Med. pres. steam
VI	J-M Wool Felt	0.400	0.421	0.442				1.10	2.59	L. p. s. and h. w.
VII	Sall-mo Expanded	0.427	0.464	0.503	0.541	0.581		1.07	3.47	High Pressure Steam
VIII	Carey Carocel	0.378	0.421	0.466	0.510	0.562	0.99	1.06	3.06	Med. and L. p. s.
IX	Carey Serated	0.468	0.506	0.546	0.587	0.634	1.00	1.13	5.66	High Pressure Steam
X	Carey Duplex	0.447	0.498	0.548			.96	1.01	1.79	L. p. s. and h. w.
XI	Carey 85% Magnesia	0.418	0.424	0.436	0.454	0.472	1.10	1.19	2.74	High Pressure Steam
XII	Sall-mo Wool Felt	0.410	0.433	0.459				1.01	3.73	L. p. s. and h. w.
XIII	Nonpareil High Pressure	0.402	0.412	0.426	0.444	0.465	1.16	1.23	2.96	H. p. & Superheated Steam
XIV	J-M Asbestos Fire Felt	0.711	0.749	0.795	0.845	0.901	.99	1.09	3.75	H. p. & Superheated Steam
XV	J-M Asbesto-Sponge Felted	0.347	0.369	0.391	0.414	0.439		1.16	4.04	H. p. & Superheated Steam
XVI	J-M Asbestocel	0.429	0.454	0.493	0.544	0.609		1.10	1.94	Med. & L. p. s. & h. w.
XVII	J-M Air Cell	0.475	0.515	0.571	0.643	0.733	1.00	1.11	1.55	L. p. s. and h. w.
XX	Plastic 85% Magnesia	0.470	0.488	0.505	0.522	0.539	1.05	1.05	3.33	Fittings & irregular surfaces
XXIV	Sall-Mo Air Cell	0.539	0.603	0.681	0.771	0.871		0.95	1.57	L. p. s. and h. w.*

*Apparent thickness is distance from pipe surface to outer surface of insulation.
NOTE.—L. p. s. = low pressure steam; h. w. = hot water.
From "Heat Insulation Facts," by L. B. McMillan, A. S. H. V. E. Journal, May, 1920.

Climatic Data

Compiled From Records of the U. S. Weather Bureau

STATE	CITY	Average Temperature Oct. 1st.-May 1st.	Lowest Temperature	Average Wind Velocity Dec. Jan. Feb. Miles per Hr.	Direction of Prevailing Wind Dec. Jan. Feb.
Ala.	Mobile	57.7	- 1	8.3	N
	Birmingham	53.9	-10	8.6	N
Ariz.	Phoenix	59.5	16	3.9	E
	Flagstaff	34.9	-25	6.7	SW
Ark.	Fort Smith	49.5	-15	8.0	E
	Little Rock	51.6	-12	9.9	NW
Cal.	San Francisco	54.3	29	.....	N
	Los Angeles	58.6	28	.....	NE
Col.	Denver	39.3	-29	7.4	S
	Grand Jct	39.2	-16	5.6	SE
Conn.	New Haven	38.0	-14	9.3	N
D. C.	Washington	43.2	-15	7.3	NW
Fla.	Jacksonville	61.9	10	8.2	NE
Ga.	Atlanta	51.4	- 8	11.8	NW
	Savannah	58.4	8	8.3	NW
Idaho	Lewiston	42.5	-13	4.7	E
	Pocatello	36.4	-20	9.3	SE
Ill.	Chicago	36.4	-23	17	SW
	Springfield	39.9	-24	10.2	NW
Ind.	Indianapolis	40.2	-25	11.8	S
	Evansville	44.1	-15	8.4	S
Iowa	Dubuque	33.9	-32	6.1	NW
	Sioux City	32.1	-35	12.2	NW
Kan.	Concordia	38.9	-25	7.3	N
	Dodge City	40.2	-26	10.4	NW
Ky.	Louisville	45.2	-20	9.3	SW
La.	New Orleans	61.5	7	9.6	N
	Shreveport	56.2	- 5	7.7	SE
Me.	Eastport	31.1	-23	13.8	W
	Portland	33.6	-17	10.1	NW
Md.	Baltimore	43.6	- 7	7.2	NW
Mass.	Boston	37.6	-13	11.7	W
Mich.	Alpena	29.1	-27	11.3	W
	Detroit	35.4	-24	13.1	SW
	Marquette	27.6	-27	11.4	NW
Minn.	Duluth	25.1	-41	11.1	SW
	Minneapolis	29.6	-33	11.5	NW
Miss.	Vicksburg	56.0	- 1	7.6	SE
Mo.	St. Joseph	40.3	-24	9.1	NW
	Springfield	43.0	-29	11.3	SE
Mont.	Billings	34.7	-49	.....	W

From "Heat Insulation Facts," by L. B. McMillan, A. S. H. V. E. Journal, May, 1920.

Climatic Data—Continued

STATE	CITY	Average Temperature Oct. 1st.-May 1st.	Lowest Temperature	Average Wind Velocity Dec. Jan. Feb. Miles per Hr.	Direction of Prevailing Wind Dec. Jan. Feb.
Mont.	Havre	27.7	−57	8.7	SW
Neb.	Lincoln	37.0	−29	10.9	N
	North Platte	34.6	−35	9.0	W
Nev.	Tonopah	39.6	− 7	9.9	SE
	Winnemucca	37.9	−28	9.5	NE
N. H.	Concord	33.4	−35	6.0	NW
N. J.	Atlantic City	41.6	− 7	10.6	NW
N. Y.	Albany	35.1	−24	7.9	S
	Buffalo	34.7	−14	17.7	W
	New York	40.3	− 6	13.3	NW
N. M.	Santa Fe	38.0	−13	7.3	NE
N. C.	Raleigh	49.7	− 2	7.3	SW
	Wilmington	53.1	5	8.9	SW
N. D.	Bismark	24.5	−45	.....	NW
	Devil's Lake	18.9	−44	11.4	W
Ohio	Cleveland	36.9	−17	14.5	SW
	Columbus	39.9	−20	9.3	SW
Okla.	Oklahoma	48.0	−17	12.0	N
Ore.	Baker	34.1	−20	6.0	SE
	Portland	45.9	− 2	6.5	S
Pa.	Philadelphia	41.9	− 6	11.0	NW
	Pittsburgh	40.8	−20	13.7	NW
R. I.	Providence	37.6	− 9	14.6	NW
S. C.	Charleston	56.9	7	11.0	N
	Columbia	53.7	− 2	8.0	NE
S. D.	Huron	28.1	−43	11.5	NW
	Rapid City	32.3	−34	7.5	W
Tenn.	Knoxville	47.0	−16	6.5	SW
	Memphis	50.9	− 9	9.6	NW
Tex.	El Paso	53.0	− 2	10.5	NW
	Forth Worth	54.7	− 8	11.0	NW
	San Antonio	60.7	4	8.2	N
Utah	Modena	38.1	−24	8.9	W
	Salt Lake City	40.0	−20	4.9	SE
Vt.	Burlington	29.3	−27	12.9	S
Va.	Norfolk	49.1	2	9.0	N
	Lynchburg	45.2	− 7	5.2	NW
	Richmond	47.4	− 3	7.4	S
Wash.	Seattle	45.3	3	9.1	SE
	Spokane	37.5	−30	.....	SW
W. Va.	Elkins	38.8	−21	4.8	W
	Parkersburg	41.9	−27	6.6	S
Wis.	Green Bay	28.6	−36	12.8	SW
	La Crosse	31.2	−43	5.6	NW
	Milwaukee	33.0	−25	11.7	W
Wyo.	Sheridan	31.0	−45	5.3	NW
	Lander	28.9	−36	3.0	NE

Indirect Data

Setting Indirect Radiators

INDIRECT Radiators are used for ventilating and for foot warmers, and for those places where radiators in the rooms would be objectionable.

In setting indirect stacks, care should be taken to see that both sides and ends come in contact with casings to prevent the passage of air other than directly through the radiator. A space of at least ten inches should be provided above the top and six to eight inches below the bottom of radiator for free circulation of air. The fresh air should be delivered to under side of radiator at opposite end from which the warm air is taken.

Satisfactory results are obtained by placing the register on the inside wall or near to an inside wall, when desired in floor. The warm air should be delivered to register from the top at one end of radiator.

Because the cold air comes in contact with Indirect Radiators, their cooling power is greatly increased over direct radiation and varies with the temperature, volume and velocity of air entering the stack.

Under ordinary conditions in house heating, indirect radiation will give off 400 to 650 B. t. u. for steam or 240 to 390 B. t. u. for water per square foot per hour. In ventilating school or other public buildings by gravity the above can be increased from one-half to two times. It is good engineering practice, when possible, to connect indirect stacks with a separate flow and return main from boiler.

The following table will be found of much value when designing or installing Indirect Radiators.

Sizes of Air Ducts and Registers for Indirect Heating

Square Feet of Radiation	Cold Air Duct to Stack		Warm Air Duct		Registers		Tappings Inches
	For First Floors Square Inches	For Upper Floors Square Inches	For First Floors Square Inches	For Upper Floors Square Inches	For First Floors Inches	For Upper Floors Inches	
40	40	35	60	40	10x12	8x10	1 x ¾
50	50	40	75	50	10x12	8x10	1 x ¾
60	60	45	90	60	10x14	8x12	1¼x1
70	70	50	105	70	12x15	10x12	1¼x1
80	80	60	120	80	12x15	10x12	1¼x1
90	90	70	135	90	12x19	10x14	1½x1¼
100	100	75	150	100	12x19	12x15	1½x1¼
120	110	90	170	110	16x16	12x15	1½x1¼
140	120	105	190	120	16x18	12x18	2 x1½
160	130	120	210	130	16x20	12x20	2 x1½

For heat losses from indirect Radiators, see page 184.
For Air Space between sections, see pages 74 and 75.

Absolute Temperature

ABSOLUTE zero of temperature is 491.6 Fahrenheit below the melting point of ice, 32° Fahrenheit. It is only necessary to add (491.6°—32°) to the actual thermometer reading to get the absolute temperature. For engineering work 460° is used rather than 459.6.

Heat

The unit of heat quantity in the English system is known as a British Thermal Unit—B. t. u. and is the amount of heat required to raise 1 pound of water from 62° to 63° Fahrenheit, while in the French system the unit is called a Calorie and is the amount of heat required to raise 1 kilogram of water from 15° to 16° centigrade (C). Since 1 k. g. = 2.2046 pounds and 1° C = 9/5 F, then 1 Cal. = (2.2046 x 9/5) = 3.968 B. t. u. or 1 B. t. u. = .252 Cal. In engineering work it is sufficiently accurate to consider a B. t. u. as the mean or average amount of heat per degree required to raise 1 pound of water from 32° to 212° F.

The specific heat of any substance can be expressed as the number of B. t. u. required to raise or lower the temperature of 1 pound at a given temperature 1 degree F.

When heat is added to a substance without change of state we increase its temperature and the heat thus added is known as sensible heat. When heat added to a substance causes a change of state from solid to a liquid, without increasing its temperature, the heat thus added is known as latent heat of fusion, and when heat added causes a change of state from liquid to vapor, the heat thus added is known as latent heat of evaporation. In the case of water at atmospheric pressure, evaporation takes place at 212° F. and the latent heat amounts to 970.4 B. t. u. per pound of water.

Heat by conduction is a molecular transmission of heat, the material in question transmitting the heat from particle to particle of its own substance. This transmission will only occur between any two sections of the material which are at different temperatures, the heat always flowing from the higher to the lower temperature.

Heat by convection is the transmission of heat by the circulation of one substance over the surface of a hotter or colder body.

Heat by radiation is the transmission of heat through a medium commonly known as ether, in the same manner that light is transmitted.

Air

Pure air is a mechanical mixture of oxygen, nitrogen, and a few other elements; that is, the elements can be separated from each other by purely physical means without regard for other constituents. The chief constituents are as follows:

	By volume	By weight
Oxygen	20.941	23.124
Nitrogen	78.122	75.539
Argon	0.937	1.337

Included with the parts named above are small quantities of other elements as follows—by volume:

Carbon Dioxide	.03	Krypton	.028	Neon	.00038
Hydrogen	.01	Xenon	.005	Helium	.000056

The specific density or weight per cubic foot of dry air decreases with the temperature, and, conversely, the specific volume, or volume per pound, which is always the reciprocal of the density, increases with the temperature. See table "Properties of Air."

Air Required For Ventilation

AN ADULT must have each hour for respiration and transpiration 215 feet or 215 X.077 = 16.55 pounds of air, and generates approximately 400 B. t. u. of which 110 units are in the form of vapor and 290 units radiate to surrounding objects.

Good practice requires not less than 1800 cubic feet of air per hour to cover all requirements for each person.

Each cubic foot of gas burned requires 8.5 cubic feet of air. Each pound of oil burned requires 150 cubic feet of air. Each pound of candle burned requires 160 cubic feet of air.

*B.t.u. given off by an adult per hour, 290.

B.t.u. given off by burning 1 cubic foot gas, 600.

B.t.u. given off by burning 1 lb. oil or candles, 15,000 to 18,000.

Average gas burner consumes approximately 4 cubic feet of gas per hour which equals 2,400 B.t.u.

Each flame from oil lamp, 430 to 515 B.t.u. per hour. Each candle 454 to 545 B.t.u. per hour.

* B.t.u. = British thermal units

Ventilation

Table Showing the Quantity of Air, in Cubic Feet, Discharged per Minute Through a Flue of Which the Cross-Sectional Area Is One Square Foot

(External Temperature of the Air, 32° Fahr.; Allowance for Friction, 50 Per Cent.)

Height of Flue in Feet	Excess of Temperature of Air in Flue above that of External Air							
	10°	15°	20°	25°	30°	50°	100°	150°
1	34	42	48	54	59	76	108	133
5	76	94	109	121	134	167	242	298
10	108	133	153	171	188	242	342	419
15	133	162	188	210	230	297	419	514
20	153	188	217	242	265	342	484	593
25	171	210	242	271	297	383	541	663
30	188	230	265	297	325	419	593	726
35	203	248	286	320	351	453	640	784
40	217	265	306	342	375	484	684	838
45	230	282	325	363	398	514	724	889
50	242	297	342	383	419	541	765	937
60	264	325	373	420	461	594	835	1006
70	286	351	405	465	497	643	900	1115
80	306	375	453	485	530	688	965	1185
90	324	398	460	516	564	727	1027	1225
100	342	420	485	534	594	768	1080	1325
125	383	468	542	604	662	855	1210	1480
150	420	515	596	665	730	942	1330	1630

Above table for Gravity Ventilation taken from standard authorities but not guaranteed.

B. T. U. Required For Heating Air

This table specifies the quantity of heat in British thermal units required to raise one cubic foot of air through any given temperature interval.

External Temp.	Temperature of Air in Room									
	40°	50°	60°	70°	80°	90°	100°	110°	120°	130°
-40°	1.802	2.027	2.252	2.479	2.703	2.928	3.154	3.379	3.604	3.829
-30°	1.540	1.760	1.980	2.200	2.420	2.640	2.860	3.080	3.300	3.520
-20°	1.290	1.505	1.720	1.935	2.150	2.365	2.580	2.795	3.010	3.225
-10°	1.051	1.262	1.473	1.684	1.892	2.102	2.311	2.522	2.732	2.943
0°	0.822	1.028	1.234	1.439	1.645	1.851	2.056	2.262	2.467	2.673
10°	0.604	0.805	1.007	1.208	1.409	1.611	1.812	2.013	2.215	2.416
20°	0.393	0.590	0.787	0.984	1.181	1.378	1.575	1.771	1.968	2.165
30°	0.192	0.385	0.578	0.770	0.963	1.155	1.345	1.540	1.733	1.925
40°	0.000	0.188	0.376	0.564	0.752	0.940	1.128	1.316	1.504	1.692
50°	0.000	0.000	0.184	0.367	0.551	0.735	0.918	1.102	1.286	1.470
60°	0.000	0.000	0.000	0.179	0.359	0.538	0.718	0.897	1.077	1.256
70°	0.000	0.000	0.000	0.000	0.175	0.350	0.525	0.700	0.875	1.049

Above table from F. Schumann's Manual of Heating and Ventilation, pages 64 and 41.

Moisture Absorbed by Air

The quantity of water which air is capable of absorbing to the point of maximum saturation, in grains per cubic foot for various temperatures.

Degrees Fahr.	Grains in a Cu. Ft.	Degrees Fahr.	Grains in a Cu. Ft.	Degrees Fahr.	Grains in a Cu. Ft.	Degrees Fahr.	Grains in a Cu. Ft.
−20	0.219	25	1.611	55	4.849	75	9.356
−10	0.356	30	1.958	57	5.191	77	9.961
− 5	0.450	32	2.113	60	5.744	80	10.933
0	0.564	35	2.366	62	6.142	85	12.736
5	0.705	40	2.849	65	6.782	90	14.791
10	0.873	45	3.414	67	7.241	95	17.124
15	1.075	50	4.076	70	7.980	100	19.766
20	1.321	52	4.372	72	8.508	105	22.751

Cubic Space Required per Person

Cubic space is an important factor in ventilation. Dr. Billings recommends the following as the minimum amount of space to be allowed per occupant.

Lodging or tenement house.....300 cubic feet per person.
School room.....250 cubic feet per person.
Hospital ward.....1,000-1,400 cubic feet per person.
Auditoriums.....200 cubic feet per person.

In computing cubic space for this purpose, all space over 12 feet above the floor should not be considered.

Heat Losses From Indirect Radiators

Standard Pin

Cubic Feet of Air Passing per Sq. Ft. of Radiation	Increase in Temperature of the Air Passing Radiator	Pounds of Steam Condensed per Sq. Ft. of Radiation	B.t.u. per Sq. Ft. per Degree Difference in Temperature of Air and Steam
50	147	.137	.859
75	143	.200	1.23
100	140	.262	1.60
125	138	.324	1.97
150	135	.379	2.29
175	132	.432	2.58
200	130	.484	2.88
225	127	.535	3.14
250	123	.576	3.35
275	121	.623	3.60
300	119	.667	3.83

In school buildings and in buildings where the flues are of ample size the amount of air passing per square foot of radiating surface may be assumed to be 200 cubic feet per hour. In residences and buildings where the flues are usually small, the amount of air passing per square foot of surface per hour does not exceed 150 cubic feet.

NOTE.—Above information is quoted from Notes on Heating and Ventilation by Professor John R. Allen.

Properties of Air

Temp. Degrees Fahrenheit	B. T. U. Absorbed by 1 Cubic Foot Dry Air per Degree Fahr.	B. T. U. Absorbed by 1 Cubic Foot Saturated Air per Degree Fahr.	Cubic Feet Dry Air Warmed 1 Degree per B. T. U.	Cubic Feet Saturated Air Warmed 1 Degree per B. T. U.
0	0.02056	0.02054	48.5	48.7
12	0.02004	0.02006	50.1	50.0
22	0.01961	0.01963	51.1	51.0
32	0.01921	0.01924	52.0	51.8
42	0.01882	0.01884	53.2	52.8
52	0.01847	0.01848	54.0	53.8
60	0.01818	0.01822	55.0	54.6
62	0.01811	0.01812	55.2	54.7
70	0.01777	0.01794	56.3	55.5
72	0.01777	0.01790	56.5	55.8
82	0.01744	0.01770	57.2	56.5
92	0.01710	0.01751	58.5	57.1
100	0.01690	0.01735	59.1	57.8
102	0.01682	0.01731	59.5	57.8
112	0.01651	0.01711	60.6	58.5
122	0.01623	0.01691	61.7	59.1
132	0.01596	0.01670	62.5	59.9
142	0.01571	0.01652	63.7	60.6
152	0.01544	0.01634	65.0	61.5
162	0.01518	0.01616	66.2	62.4
172	0.01494	0.01598	67.1	63.5
182	0.01471	0.01580	68.0	64.2
192	0.01449	.....	68.9	....
202	0.01426	.....	69.5	....
212	0.01406	.....	71.4	....

Volume and Density of Air

at Various Temperatures

Temp. Degrees Fahr.	Volume of 1 lb. of Air at Atmospheric Pressure of 14.7 lbs. Cubic Feet	Density or Weight of 1 Cu. Ft. of Air at 14.7 lbs. Pressure Lbs.	Temp. Degrees Fahr.	Volume of 1 lb. of Air at Atmospheric Pressure of 14.7 lbs. Cubic Feet	Density or Weight of 1 Cu. Ft. of Air at 14.7 lbs. Pressure Lbs.
0	11.583	0.086331	210	16.860	0.059313
32	12.387	0.080728	212	16.910	0.059135
40	12.586	0.079439	220	17.111	0.058442
50	12.840	0.077884	240	17.612	0.056774
62	13.141	0.076097	260	18.116	0.055200
70	13.342	0.074950	280	18.621	0.053710
80	13.593	0.073565	300	19.121	0.052297
90	13.845	0.072230	320	19.624	0.050950
100	14.096	0.070942	340	20.126	0.049686
120	14.592	0.068500	360	20.630	0.048476
140	15.100	0.066221	380	21.131	0.047322
160	15.603	0.064088	400	21.634	0.046223
180	16.106	0.062090	425	22.262	0.044920
200	16.606	0.060210	450	22.890	0.043686

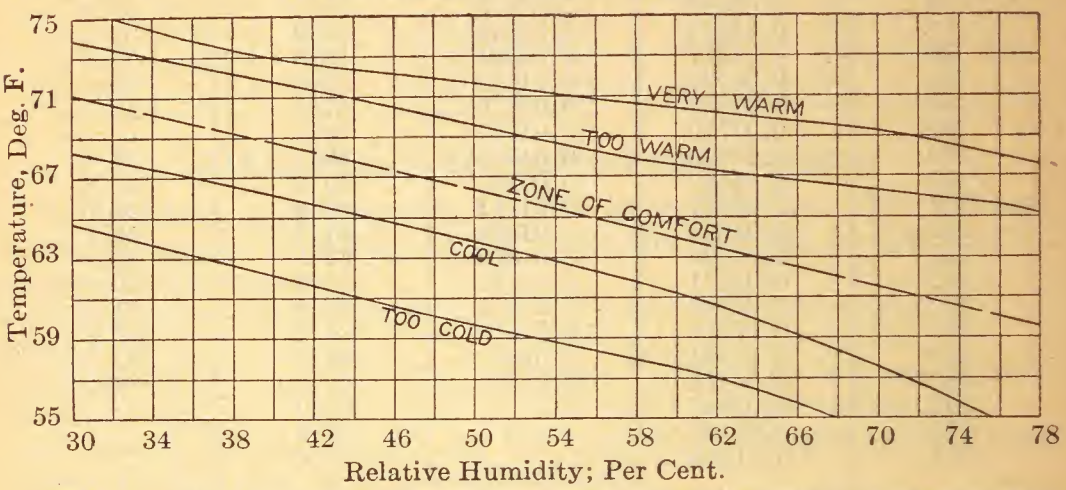
Note.—Above information is quoted from standard authorities. Not guaranteed.

Temperature and Humidity

One of the chief objects sought when air for ventilation is provided is the establishment of such conditions that heat will be removed from the human body at a rate favorable for comfort and health. Heat is lost from the body in three ways: By radiation, by convection, and by evaporation of moisture from the skin.

The amount of heat lost due to the evaporation of perspiration from the skin depends upon the *relative humidity* of the air and upon the amount of air motion. Comfortable conditions can exist through a rather wide range of temperature and relative humidity provided that the combination of the two is such to cause the proper rate of heat loss from the body.

Comfort Zone Chart



This comfort zone chart showing the proper relation between the temperature and humidity was constructed by Dr. E. V. Hill from a series of tests made by Prof. J. W. Shepard. From the center line of the "Comfort Zone" shown in the chart it will be noted that equally comfortable conditions can be secured with a temperature of 65° and a humidity of 56 per cent as with a temperature of 70° and a humidity of 36 per cent.

By humidity is meant the atmospheric moisture. ***Absolute humidity*** is the actual vapor content expressed in grains per cubic foot or per pound of air. The ratio of the vapor content to the vapor content of saturated air at the same temperature expressed in per cent is called the *relative humidity.* For example, given a sample of air at 70° having an absolute humidity of 4 grains per cubic foot; since saturated air at 70° contains 8 grains the relative humidity is 50 per cent.

A convenient and simple means for measuring humidity is through the use of the wet and dry bulb thermometer. The instrument consists of two mercury thermometers, the bulb of one of which is covered with cotton wicking. The end of the wicking extends into a bottle of water and the entire length is kept wet by absorption. As the water is evaporated from the wicking its temperature is lowered to that of saturation or wet-bulb temperature.

Before reading the thermometers, air should be circulated over them by fanning until the readings are constant. By observing the difference between the wet and dry bulb readings the relative humidity may be determined from the table on the following page.

From "Heating and Ventilation" by Allen and Walker.

Relative Humidities

Difference between the dry and wet thermometers.

Air temperatures	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	Air temperatures
30	100	89	78	67	57	47	36	26	17	7																												30
35	100	91	82	73	65	54	45	37	28	19	12	3																										35
40	100	92	84	76	68	60	53	45	38	30	22	16	8	1																								40
45	100	92	85	78	71	64	58	51	44	38	32	25	19	13	7	1																						45
50	100	93	87	80	74	67	61	55	50	44	38	33	27	22	16	11	6	1																				50
55	100	94	88	82	76	70	65	59	54	49	43	39	34	29	24	19	16	10	6	1																		55
60	100	94	89	84	78	73	68	63	58	53	48	44	39	34	30	26	22	18	14	10	6	2																60
65	100	95	90	85	80	75	70	65	61	56	52	48	44	39	35	31	28	24	20	17	13	10	6	3														65
70	100	95	90	86	81	77	72	68	64	60	55	52	48	44	40	36	33	29	26	23	19	16	13	10	7	4	1											70
75	100	95	91	87	82	78	74	70	66	62	58	55	51	47	44	40	37	34	31	27	24	21	19	16	13	10	7	5	2									75
80	100	96	92	87	83	79	75	72	68	64	61	57	54	51	47	44	41	38	35	32	29	26	23	20	18	15	13	10	8	6	3	1						80
85	100	96	92	88	84	80	77	73	70	66	63	60	56	53	50	47	44	41	38	36	33	30	28	25	22	20	17	15	13	11	9	6	4	2				85
90	100	96	92	88	85	81	78	75	71	68	65	62	59	56	53	50	47	44	41	39	36	34	32	29	26	24	22	20	17	15	13	11	9	7	5	3	2	90
95	100	96	93	89	86	82	79	76	72	69	66	63	60	58	55	52	49	47	44	42	39	37	35	32	30	28	25	23	21	19	17	15	14	11	10	8	6	95
100	100	97	93	90	86	83	80	77	74	71	68	65	62	59	57	54	51	49	46	44	42	39	37	35	33	31	29	27	25	23	21	19	17	15	14	12	10	100
105	100	97	93	90	87	84	81	78	75	72	69	66	64	61	58	56	53	51	49	46	44	42	40	38	35	33	31	30	28	26	24	22	20	19	17	15	14	105
110	100	97	94	90	87	84	81	78	76	73	70	67	65	62	60	57	55	53	50	48	46	44	42	40	38	36	34	32	30	28	26	24	23	21	20	18	17	110
115	100	97	94	91	88	85	82	79	76	74	71	69	66	64	61	59	57	54	52	50	48	46	44	42	40	38	36	34	33	31	29	28	26	24	23	21	20	115
120	100	97	94	91	88	85	83	80	77	75	72	70	67	65	62	60	58	56	54	51	49	47	45	43	42	40	38	36	35	33	31	30	28	27	25	24	22	120
125	100	97	94	91	88	86	83	80	78	75	73	70	68	66	64	62	59	57	55	53	51	49	47	45	43	42	40	38	37	35	33	32	31	29	27	26	24	125
130	100	97	94	91	89	86	83	81	78	76	74	71	69	67	65	62	60	58	56	54	52	50	49	47	45	43	41	40	38	37	35	34	32	31	30	28	27	130
135	100	97	94	92	89	86	84	81	79	77	74	72	70	68	65	63	61	59	57	55	53	51	50	48	46	45	43	41	40	38	37	35	34	32	31	30	28	135
140	100	97	95	92	89	87	84	82	79	77	75	73	71	68	66	64	62	60	58	56	55	53	51	49	48	46	44	43	41	40	38	37	35	34	33	31	30	140
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	

Air temperatures

Hoffman's Handbook for Heating and Ventilating Engineers.

Assembling Position of Boiler Sections

Steam or Water

Size 180 Series

184-F-*S-X-B
185-F-*S-M-X-B
186-F-*S-M-M-X-B
187-F-*S-M-M-M-X-B

200 Series

204-F-S-T-B
205-F-S-M-T-B
206-F-S-M-M-T-B
207-F-S-M-T-M-T-B

235-F-T-M-X-B
236-F-M-T-N-X-B
237-F-T-M-T-M-X-B

Size G270 Series

G-276-F-*S-M-M-X-B
G-277-F-*S-M-M-M-X-B
G-278-F-*S-M-T-M-M-X-B
G-279-F-*S-M-M-T-M-M-X-B

250 Series

255-F-S-M-X-B
256-F-S-M-M-X-B
257-F-S-M-T-M-X-B
258-F-S-M-M-T-N-X-B

230 Series

238-F-M-T-M-T-V-X-B
239-F-T-M-T-M-T-V-X-B
240-F-M-T-M-T-M-T-V-X-B

WN270 Series

LEFT HAND		RIGHT HAND
B-X-M-M-T-F	WN276	F-A-T-M-Y-B
B-X-M-M-M-M-F	WN277	F-A-T-M-T-Y-B
B-X-V-M-M-M-M-F	WN278	F-A-T-M-T-V-Y-B
B-X-V-M-T-M-M-M-F	WN279	F-A-T-M-M-T-V-Y-B
B-X-V-M-M-T-M-M-M-F	WN280	F-A-T-M-M-M-T-V-Y-B
B-X-V-M-M-T-M-M-M-M-F	WN281	F-A-T-M-M-M-M-T-V-Y-B
B-X-V-V-M-M-T-M-M-M-M-F	WN282	F-A-T-M-M-M-M-T-V-V-Y-B
B-X-V-V-M-M-T-M-M-M-M-T-F	WN283	F-A-M-M-T-M-M-M-T-V-V-Y-B
B-X-V-V-M-M-T-M-M-M-M-M-T-F	WN284	F-A-M-M-T-M-M-M-M-T-V-VYB

400 Series

408	F.A.M.C.W.M.Y.B.	412	F.A.N.N.C.T.W.M.Y.V.V.B.
409	F.A.N.C.W.M.Y.V.B.	413	F.A.N.N.M.C.T.W.M.Y.V.V.B.
410	F.A.N.T.C.W.M.Y.V.B.	414	F.A.N.N.T.C.M.W.T.M.Y.V.V.B.
411	F.A.N.M.T.C.W.M.Y.V.B.		

500 Series

LEFT HAND		RIGHT HAND
B-X-V-W-C-M-L-F	508	F-A-T-C-W-X-Y-B
B-X-V-W-C-T-M-L-F	509	F-A-T-M-C-W-X-Y-B
B-X-V-W-M-C-T-M-L-F	510	F-A-T-M-C-T-W-V-Y-B
B-X-V-X-W-M-C-M-M-L-F	511	F-A-T-M-C-T-W-V-V-Y-B
B-X-V-X-M-W-M-C-T-M-L-F	512	F-A-T-M-C-T-W-M-V-V-Y-B

Key to Sections

F—Front.
A—Water Column Section.
S—Middle Special Tapped.
M—Middle.
T—Plain Tap.
L—Left Hand Next to Front.
W—Bridge Wall.
N—Next to Front.
Y—Safety Valve Section.
X—Next to Back Tap.
V—Next to Back Middle.
B—Back.
C—Curtain.
*S—Return Tapping on Left Side.

Capitol-Winchester—Steam or Water

Dome Outer Hole Section, Fire Pot	Dome Outer Hole Section, Center Hole Section, Fire Pot	Dome Outer Hole Section, Center Hole Section, Outer Hole Section, Fire Pot	Dome Outer Hole Section, Center Hole Section, Outer Hole Section, Center Hole Section, Fire Pot
3130–4130	3140–4140	3350–4350	3460–4460
3230–4230	3240–4240	3450–4450	3560–4560
3330–4330	3340–4340	3550–4550	3660–4660
	3440–4440	3650–4650	
	3540–4540		
	3640–4640		

NOTE—The names of parts arranged in order as placed in boiler from dome downward.

An Outer Hole Intermediate Section is always placed next to dome. When increasing or decreasing boilers place or remove section next to fire pot.

Basis of Boiler Ratings

THE rating of steam boilers is based upon a gauge pressure of 2 pounds at the boiler and the condensation of 0.25 pounds of steam per square foot of radiating surface standing in still air at 70 degrees.

The rating of water boilers is based upon water leaving the boiler at 180 degrees temperature and the transmission of 150 B.t.u.'s per square foot of radiating surface standing in still air at 70 degrees.

The above are accepted factors for direct cast iron radiation.

All other forms of radiating surface must be reduced to the equivalent of direct cast iron.

The square feet of surface in mains, branches, and returns should be carefully determined and the condensation for steam or cooling effect for water expressed in equivalent of direct cast iron (See Table Below) and added to direct radiation. For ordinary house heating conditions a square foot of surface in mains is assumed to condense 0.30 pounds of steam per hour, owing to the character of cooling surfaces and relatively low basement temperatures. Piping having greater exposure will have a higher condensation. (See table, page 199.)

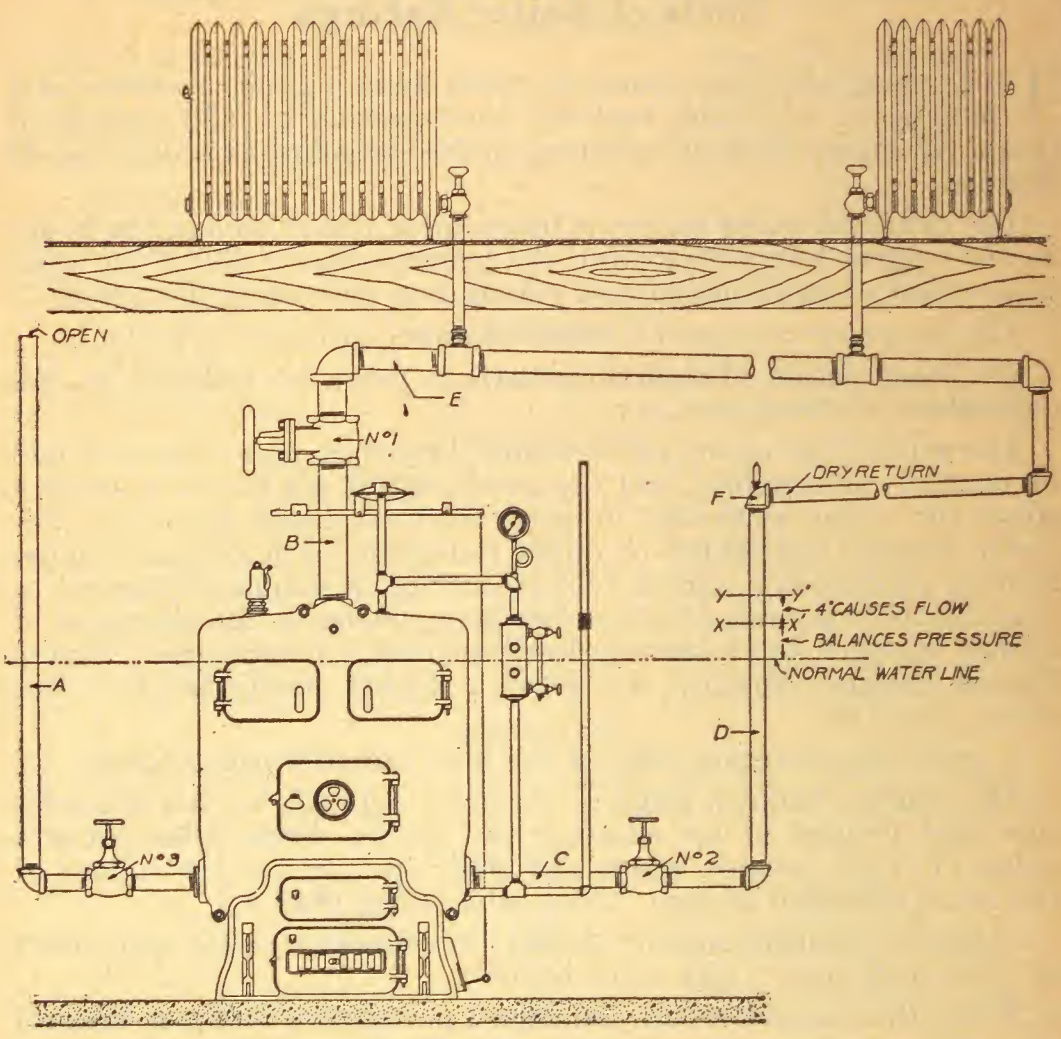
A good pipe covering reduces the heat radiated from piping.

The condensation in indirect radiators depends on the temperature and volume of air entering the stack. Prof. Allen gives a value of 0.432 pounds when 175 cubic feet of air per square of surface is admitted at zero. (See table, page 184.)

Indirect radiating surface should be expressed in its equivalent of direct cast iron. (See table below.)

When the pounds steam condensed per square foot per hour of any surface is known its equivalent in direct cast iron surface may be determined by multiplying the amount of surface in square feet by the factor corresponding to that condensing power, given in table below.

Condensing Power, Lbs.	Factor	Condensing Power, Lbs.	Factor	Condensing Power, Lbs.	Factor
.20	.80	.30	1.20	.40	1.60
.21	.84	.31	1.24	.41	1.64
.22	.88	.32	1.28	.42	1.68
.23	.92	.33	1.32	.43	1.72
.24	.96	.34	1.36	.44	1.76
.25	1.00	.35	1.40	.45	1.80
.26	1.04	.36	1.44	.46	1.84
.27	1.08	.37	1.48	.47	1.88
.28	1.12	.38	1.52	.48	1.92
.29	1.16	.39	1.56	.49	1.96



Water Line Troubles in Steam Boilers

ONE of the common causes of water line troubles in steam boilers is insufficient distance between the normal water line of the boiler and the dry return to take care of the inequality in pressure in the heating system.

In the accompanying cut, if the boiler is filled with water to normal water line at center of gauge glass; valves Nos. 1 and 2 are closed, and No. 3 opened, the water will stand in the open pipe "A" at the same height as the water in the boiler.

If a fire is built in the boiler, the steam generated being unable to escape through the pipe "B" will accumulate a pressure which will raise the water in the pipe "A." As the pressure increases the water in the vertical pipe "A" will be raised until the static head of water balances the steam pressure. Every pound of pressure generated will raise the water in the pipe "A" approximately 28″. If the steam pressure were raised high enough the water would be driven out of the top of the vertical pipe.

(Concluded on page 191)

Water Line Troubles in Steam Boilers

(Concluded)

In an enclosed steam heating plant a similar condition exists, the water in the vertical return pipes balancing the difference in pressure created by the condensation of the steam and pressure loss due to friction.

If the valves 1 and 2 are opened, and No. 3 closed the water stands in the return pipe "D" at the normal water line level; when steam is formed in the boiler it flows through the vertical pipe "B" and is distributed to the radiators through the horizontal pipe "E." As the steam is condensed its pressure is lost. The frictional loss due to the steam passing through fittings and pipe always causes a drop in pressure, and if the pipe "E" is long, or too small this loss in pressure becomes a very important consideration and, added to the natural drop in pressure due to the condensing of the steam, results in a material difference in pressure in the system at the points "B" and "F."

As an example, assume that the steam supply main "E" is 125 feet long, and its size has been determined to allow for a pressure drop of 3 ounces. When the steam gauge on the boiler registers two pounds, a steam gauge if placed at "F" would show 29 ounces, and to equalize this difference in pressure the water in pipe "D" would be raised approximately 5¼ inches (1.732 inches per ounce) to a line indicated by X—X′.

Water standing at the height X—X′ represents balanced pressures in the system. However, as steam is condensed, it is necessary to return to the boiler the water accumulating in the pipe "D." To do this the pressure in pipe "D" must exceed the pressure in the boiler, requiring an additional 4 inches of head, making total elevation of 9¼ inches in the return, as indicated by the line Y—Y′.

On account of the high frictional loss often found and increased pressure drop when system is first heating, it is advisable to maintain a distance of at least 18 inches between the normal water line and the point "F," which is the low point of the dry return.

Blowing Off a Steam Boiler

A steam boiler should be blown off within one week after it is in operation, to remove the unavoidable accumulation of oil, grease, etc., which have a tendency to cause foaming, preventing the generation of steam and causing an unsteady water line. This can only be done when the boiler is under fire. If one blowing off does not result in a steady water line and clean gauge, the operation must be repeated a second, or if necessary, a third and fourth time.

1. Close all radiator valves, or, if the mains are valved, close both flow and return valves tightly, remove damper regulator and plug the opening.

2. Remove 1″ plug in steam space on front of boiler and connect a blow-off pipe to the opening, extending to a suitable drain or out of the basement window. The size of this pipe should be the same as the tapping and should be provided with full size cock.

3. With sufficient fire in the boiler to keep the water at the boiling point, turn on the cold water supply enough to cause the water in the boiler to overflow slowly through the blow-off pipe until the surface of the water line is thoroughly skimmed of all oil and grease. At intervals the water supply and blow-off valves should be closed to allow the temperature of the water to be raised.

4. Allow the fire to burn very low and lower the water in the boiler to the normal water line. Close the blow-off cock and raise fifteen pounds pressure with a wood fire. Open blow-off cock allowing pressure to cause water to be siphoned through pipe, thus carrying away the surface grease and oil, maintaining the steam pressure at fifteen pounds. Supply cold water at the bottom of boiler to maintain a steady siphoning of water. After this operation has been continued for two hours, close the surface blow-off cock and water supply and open drain cock at bottom of boiler, being careful that sufficient fire is carried to maintain a pressure until the last gallon of water is blown out.

5. Draw the remaining fire and open all fire and flue doors wide.

6. Allow the boiler to become cool, close drain cock, remove surface blow-off piping, replace plug and damper regulator and fill boiler slowly to the normal water line.

7. Open radiator, flow and return valves.

8. Rebuild fire.

On large boilers it may be desirable at times to make surface blow-off connections at the Safety Valve tapping, in which case it will be necessary to carry a higher water line to accomplish the siphoning action. The rest of the operation will be as already described.

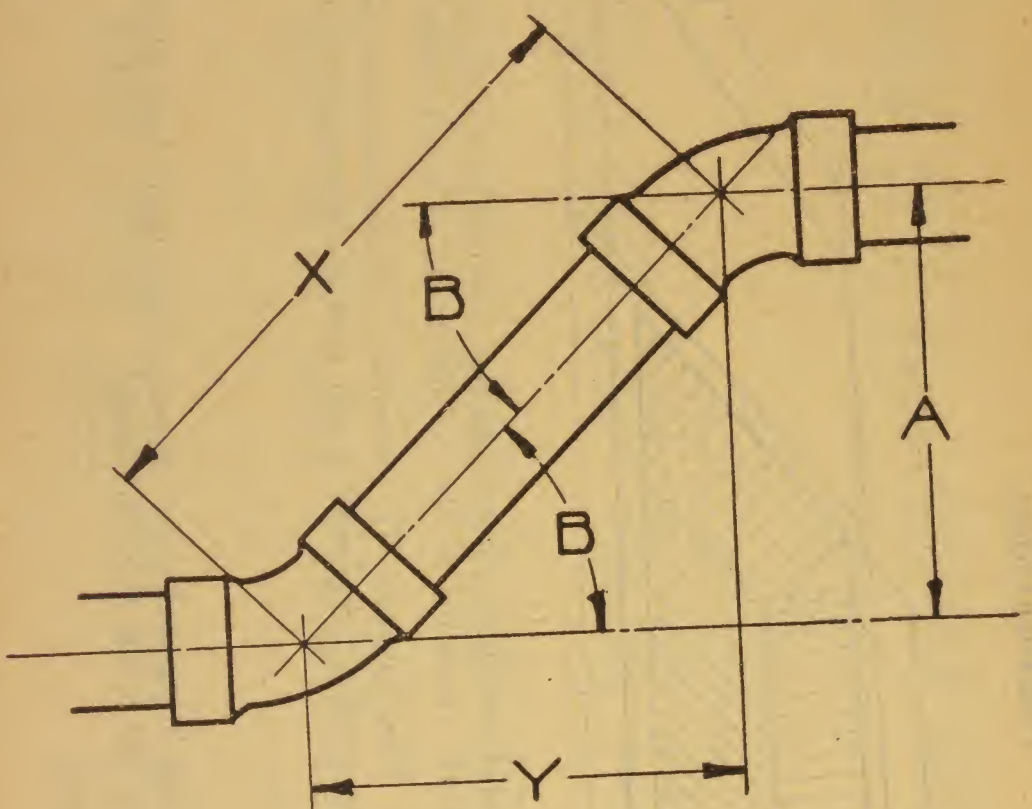
In boilers where a large amount of oil and grease is present it may be desirable to add a small quantity of soda ash, which should be boiled in boiler for half an hour before the blowing off operation is started.

Five pounds of soda ash for small sizes up to thirty pounds for the largest boilers, will usually be sufficient.

In cases where there is no water supply pressure the surface blowing off cannot be a continuous operation. Therefore, the bottom blow-off should be repeated several times.

Formula For Offset Connections

Used in General Practice

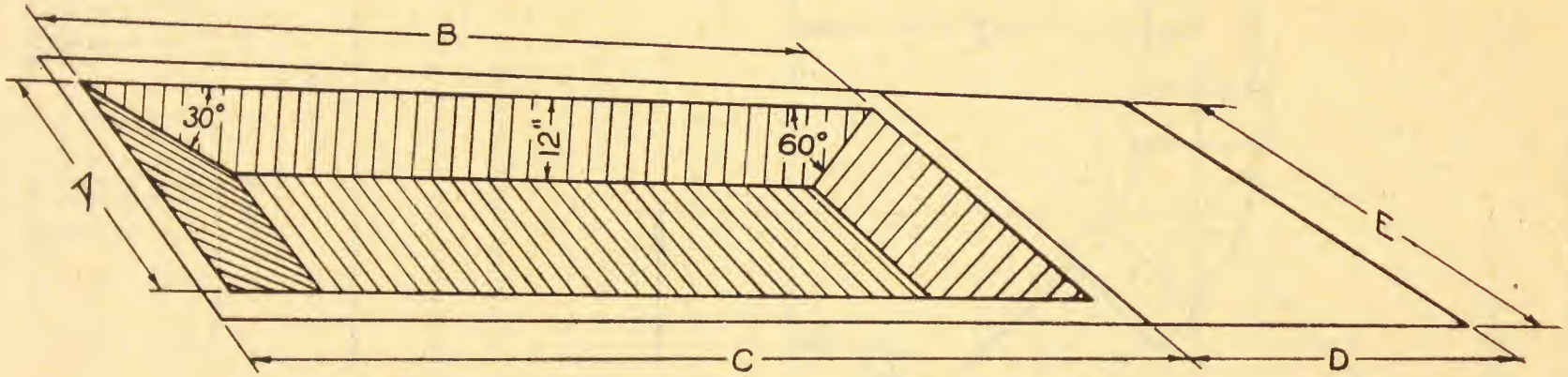


X (Center to Center) = A (Offset) Multiplied by Constant.

Y (Center to Center) = A (Offset) Multiplied by Constant.

B—Angle	Constant	
	For X	For Y
60 Degrees	1.15	.58
45 Degrees	1.41	1.00
30 Degrees	2.00	1.73
22½ Degrees	2.61	2.41
11¼ Degrees	5.12	5.02
5⅝ Degrees	10.20	10.15

Foundations



WE recommend the construction of a pit and foundation similar to the above sketch with all Capitol square boilers as 95% of burned grates are directly traceable to the accumulation of ashes under grates.

Complete dimensions are found on page 195. Measurement "D" pertains to Smokeless boilers and sizes 282, 283 and 284 of the WN-270 Series, as these heaters employ bridgewall which shortens pit dimensions.

A—Width of pit.

B—Length of pit.

C—Length of base for boilers not employing bridgewall, also distance from front base plate to bridgewall on all Smokeless boilers and sizes 282, 283, 284 of the WN-270 Series.

D—Distance from bridgewall to rear base plate.

E—Width of base.

Foundation and Pit Dimensions for Capitol Boilers

BOILER NO.	A Inches	B Inches	C Inches	D Inches	E Inches
184	19½	14¼	20¼		25½
185	19½	20½	26½		25½
186	19½	26¾	32¾		25½
187	19½	33	39		25½
204	22¾	17½	23½		28¾
205	22¾	23¾	29¾		28¾
206	22¾	30	36		28¾
207	23¾	36¼	42¼		28¾
255	28¼	31¼	37¼		34¼
256	28¼	39¼	45¼		34¼
257	28¼	47¼	53¼		34¼
258	28¼	55¼	61¼		34¼
G-276	30	30	36		36
G-277	30	36¾	42¾		36
G-278	30	43½	49½		36
G-279	30	50¼	56¼		36
235	35¼	30½	36½		41¼
236	35¼	38¾	44¾		41¼
237	35¼	47	53		41¼
238	35¼	55¼	61¼		41¼
239	35¼	63½	69½		41¼
240	35¼	71¾	77¾		41¼
WN-276	51	43⅝	49⅝		57¾
WN-277	51	52¾	58¾		57¾
WN-278	51	61⅞	67⅞		57¾
WN-279	51	71	77		57¾
WN-280	51	80⅛	86⅛		57¾
WN-281	51	89¼	95¼		57¾
WN-282	51	89¼	95¼	9⅛	57¾
WN-283	51	89¼	95¼	18¼	57¾
WN-284	51	89¼	95¼	27⅜	57¾
408	41	30	36	27½	47
409	41	30	36	35½	47
410	41	38	44	35½	47
411	41	46	52¼	35½	47
412	41	46	52¼	43½	47
413	41	54	60⅜	43½	47
414	41	54	60⅜	51½	47
508	51	32	39⅜	28½	57¾
509	51	41	48½	28½	57¾
510	51	50	57⅝	28½	57¾
511	51	50	57⅝	37⅝	57¾
512	51	52	60	44⅜	57¾

Safety Valve Data

Capitol Squares

Boiler No.	Valve Size, Inches		Boiler No.	Valve Size, Inches	
	*A. S. M. E. Code	Chicago		*A. S. M. E. Code	Chicago
184	1	1	WN276	3	3
185	1¼	1¼	WN277	3 and 2½	3
186	1½	1¼	WN278	3 " 2½	3
187	1½	1½	WN279	3 " 3	3 and 2½
204	1¼	1¼	WN280	3 " 3	3 " 2½
205	1½	1¼	WN281	3 " 3	3 " 3
206	1½	1½	WN282	3 " 3	3 " 3
207	1½	1½	WN283	3 " 3	3 " 3
255	2	2	WN284	3 " 3	3 " 3
256	2	2	408	2½	2½
257	2½	2	409	2½	2½
258	2½	2	410	3	3
G276	2	2	411	3	3
G277	2	2	412	3	3
G278	2	2	413	3	3
G279	2½	2	414	3	3
235	2	2	508	3	2½
236	2½	2	509	3 and 2½	3
237	2½	2½	510	3 " 3	3
238	3	2½	511	3 " 3	3
239	3	2½	512	3 " 3	3
240	3	3			

Capitol Winchester

3100	1	1	3400	1½	1¼
3200	1	1	3500	2	1½
3300	1¼	1¼	3600	2	2

*American Society of Mechanical Engineers Code adopted to January 1, 1920, by California, Delaware, Indiana, Massachusetts, Michigan, Minnesota, Missouri. New Jersey, New York, Ohio, Oklahoma, Pennsylvania, Rhode Island, Tennessee, and Wisconsin.

Draft Gauge

THE U-Tube Water Gauge is the most commonly used appliance to determine the strength of draft. It is inexpensive, simple in construction and easily operated. Providing the area of flue is ample for proper volume, .12 to .15 inches of water is sufficient for small, and .15 to .2 inches for large installations. The air in flue should be warmed when the gauge is used.

The chimney flue may have area given in table, and, still, because of variations in form or construction, have insufficient intensity, resulting in an excessive consumption of fuel.

Height Water Inches	Pressure Pounds per Sq. Ft.	Velocity Feet per Second	Velocity Feet per Minute	Height Water Inches	Pressure Pounds per Sq. Ft.	Velocity Feet per Second	Velocity Feet per Minute
.10	.521	15.05	903	1.10	5.731	49.90	2994
.15	.781	18.17	1090	1.15	5.991	57.00	3060
.20	1.042	21.30	1278	1.20	6.252	52.10	3126
.25	1.302	23.05	1327	1.25	6.512	53.20	3189
.30	1.563	26.06	1564	1.30	6.773	54.20	3252
.35	1.823	28.08	1685	1.35	7.033	55.30	3315
.40	2.084	30.10	1806	1.40	7.294	56.30	3378
.45	2.344	31.76	1911	1.45	7.554	57.40	3415
.50	2.605	33.60	2016	1.50	7.815	58.20	3492
.55	2.865	35.20	2112	1.55	8.075	59.30	3523
.60	3.126	36.80	2208	1.60	8.336	60.20	3612
.65	3.386	38.30	2298	1.65	8.596	61.30	3666
.70	3.647	39.80	2388	1.70	8.857	62.00	3720
.75	3.907	41.20	2469	1.75	9.117	63.10	3774
.80	4.168	42.50	2550	1.80	9.378	63.80	3828
.85	4.478	43.80	2628	1.85	9.638	64.90	3882
.90	4.689	45.10	2706	1.90	9.899	65.60	3936
.95	4.949	46.30	2778	1.95	10.159	66.70	3987
1.00	5.210	47.50	2850	2.00	10.420	67.30	4038

Chimney Sizes

A TABLE to enable the architectural designer to arrive at the proper size of chimney for his preliminary sketches before the heating requirements have been considered.

By the use of this table, the Architect can determine the chimney size from the area of the window opening; area of exposed wall and cubical contents. These factors represent the heat losses from the building and are constant, regardless of the type of heating system installed.

Diameter or Side of Chimney in Inches, Required for Varying Values of Heat Loss Factor

Factor*	HEIGHT OF CHIMNEY IN FEET							
$G+\frac{W}{10}+\frac{C}{100}$	20	30	40	50	60	80	100	120
325	7.4	7.0	6.7	6.4	6.2	6.0	6.0	6.0
675	9.6	9.2	8.8	8.2	8.0	6.6	7.3	7.0
1000	11.3	10.8	10.2	9.6	9.3	8.8	8.5	8.2
1325	12.8	12.0	11.4	10.8	10.5	10.0	9.5	9.2
2000	15.2	14.4	13.4	12.8	12.4	11.5	11.2	10.8
2675	17.2	16.3	15.2	14.5	14.0	13.2	12.6	12.1
4000	20.6	18.5	18.2	17.2	16.6	15.8	15.0	14.4
5325	23.6	22.2	20.8	19.6	19.0	17.8	17.0	16.3
6675	26.0	24.6	23.0	21.6	21.0	19.4	18.6	18.0
8000	28.4	26.8	25.0	23.4	22.8	21.2	20.2	19.5
9325	30.4	28.8	27.0	25.5	24.4	23.0	21.6	20.8
10675	32.4	30.6	28.6	26.8	26.0	24.2	23.4	22.2
12000	34.0	32.4	30.4	28.4	27.4	25.6	24.4	23.4
13325	37.0	34.0	32.0	30.0	28.6	27.0	25.4	24.6
20000			38.4	36.2	35.0	33.0	31.0	29.2
26675			43.0	42.0	41.0	37.0	35.0	34.0
40000				50.0	48.0	46.0	43.0	41.0

* G—Glass area—sq. ft. W—Wall area—sq. ft. C—Cubic contents—ft.

Heat Transmitted Per Hour Per Sq. Ft. by Wrought Iron Pipes in Still Air

Steam

T	219.4	219.4	219.4	219.4	219.4	219.4	219.4	219.4
T1	40	45	50	55	60	65	70	75
T2	179.4	174.4	169.4	164.4	159.4	154.4	149.4	144.4
H	358.8	348.8	338.8	328.8	318.8	308.8	298.8	288.8
W	.372	.361	.351	.341	.330	.320	.3095	.299
E	1.488	1.444	1.404	1.364	1.320	1.280	1.238	1.196

P—Gauge Pressure 2.3 lbs. for steam or 180° Temp. for water.
T—Temperature of Steam at 2.3 lbs. 219.4° or Temp. of water 180°.
T1—Temperature of surrounding air.
T2—Temperature difference of steam or water and air.
H—B. T. U. Transmitted per hour per sq. ft. (T2 x 2) for steam. (T2 x 1.8) for water.
L—Latent heat of steam at 2.3 lbs. press. 965.6 B. T. U.
W—Condensation in lbs. water H ÷ L.
K—Average B. T. U. transmitted per sq. ft. per hour per degree temperature difference. Difference taken as 2 for steam and 1.8 for water. These are conservative factors.
E—Equivalent in direct cast iron.

Water

T	180	180	180	180	180	180	180	180
T1	40	45	50	55	60	65	70	75
T2	140	135	130	125	120	115	110	105
H	252	243	234	225	216	207	198	189
E	1.68	1.62	1.56	1.50	1.44	1.38	1.32	1.26

Risers For Hot Water

Floor	1	2	3	4	5	6
F	1.00	1.41	1.72	1.98	2.24	2.44

"F" is the percentage of increased surface a riser will carry due to head, taking first floor as one.

Mr. N. S. Thompson gives the following equalizing numbers, which represent relative capacities of different pipe sizes for the same friction pressure loss per hundred foot of run in mains and risers serving more than one radiator.

½ inch = 2	1¼ inch = 20	2½ inch = 110	4 inch = 380	7 inch = 1600
¾ inch = 5	1½ inch = 30	3 inch = 175	5 inch = 650	8 inch = 2250
1 inch = 10	2 inch = 60	3½ inch = 260	6 inch = 1050	

Example:

one 4 inch = 380
one 5 inch = 650

1030

One 6 inch main would supply one 4 inch and one 5 inch

Square Feet of Radiating Surface of Pipe Per Lineal Foot

On all lengths over one foot, fractions less than tenths are added to or dropped.

Length of Pipe in ft.	SIZE OF PIPE									
	¾	1	1¼	1½	2	2½	3	4	5	6
1	.275	.346	.434	.494	.622	.753	.916	1.175	1.455	1.739
2	.5	.7	.9	1.	1.2	1.5	1.8	2.4	2.9	3.5
3	.8	1.	1.3	1.5	1.9	2.3	2.7	3.5	4.4	5.2
4	1.1	1.4	1.7	2.	2.5	3.	3.6	4.7	5.8	7.
5	1.4	1.7	2.2	2.4	3.1	3.8	4.6	5.8	7.3	7.7
6	1.6	2.1	2.6	2.9	3.7	4.5	5.5	7.	8.7	10.5
7	1.9	2.4	3.	3.4	4.4	5.3	6.4	8.2	10.2	12.1
8	2.2	2.8	3.5	3.9	5.	6.	7.3	9.4	11.6	13.9
9	2.5	3.1	3.9	4.4	5.6	6.8	8.2	10.6	13.1	15.7
10	2.7	3.5	4.3	4.9	6.2	7.5	9.1	11.8	14.6	17.4
11	3.	3.8	4.8	5.4	6.8	8.3	10.	12.9	16.	19.1
12	3.3	4.1	5.2	5.9	7.5	9.	11.	14.1	17.4	20.9
13	3.6	4.5	5.6	6.4	8.1	9.8	11.9	15.3	18.9	22.6
14	3.8	4.8	6.1	6.9	8.7	10.5	12.8	16.5	20.3	24.3
15	4.1	5.2	6.5	7.4	9.3	11.3	13.7	17.6	21.8	26.1
16	4.4	5.5	6.9	7.9	10.	12.	14.6	18.8	23.2	27.8
17	4.7	5.9	7.4	8.4	10.6	12.8	15.5	20.	24.7	29.5
18	5.	6.2	7.8	8.9	11.2	13.5	16.5	21.2	26.2	31.3
19	5.2	6.6	8.3	9.4	11.8	14.3	17.4	22.3	27.6	33.1
20	5.5	6.9	8.7	9.9	12.5	15.	18.3	23.5	29.1	34.8
25	6.9	8.6	10.9	12.3	15.6	18.8	22.9	29.3	36.3	43.5
30	8.3	10.4	13.	14.8	18.7	22.5	27.5	35.3	43.6	52.1
35	9.6	12.1	15.2	17.3	21.8	26.3	32.	41.1	50.9	60.8
40	11.	13.8	17.4	19.8	24.9	30.1	36.6	47.	58.2	69.5
45	12.4	15.6	19.5	22.2	28.	33.8	41.2	52.9	65.5	78.2
50	13.8	17.3	21.7	24.7	31.1	37.6	45.8	58.7	72.7	87.
55	15.2	19.0	23.9	27.1	34.3	41.3	50.4	64.6	80.1	95.6
60	16.6	20.8	26.0	29.6	37.3	45.2	55.	70.5	87.3	104.3
65	18.0	22.6	28.2	32.1	40.5	48.8	59.5	76.4	94.5	112.9
70	19.4	24.2	30.4	34.6	43.5	52.7	64.1	82.3	101.9	121.7
75	20.7	26.0	32.6	37.1	46.6	56.5	68.7	88.1	109.1	130.4
80	22.	27.7	34.7	39.6	49.8	60.2	73.3	94.0	116.4	139.1
85	23.4	29.4	36.9	42.0	53.4	63.9	77.8	99.9	123.7	147.9
90	24.8	31.1	39.1	44.5	56.	67.8	82.4	105.8	130.9	156.5
95	26.2	32.9	41.2	46.9	59.6	71.5	87.2	111.6	138.2	165.2
100	27.5	34.6	43.4	49.4	62.2	75.3	91.6	117.5	145.5	173.9

The above table will be found very convenient in estimating the amount of radiating surface in mains, etc.

NOTE—Above information is quoted from standard authorities. Not guaranteed.

Reduce all radiating surface to equivalent indirect surface.

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Length of Pipe in ft.

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NUMBER OF THREADS PER INCH OF SCREW							27	18	18	14	14
NUMBER OF PERFECT THREADS							5.13	5.22	5.40	5.46	5.60
TOTAL LENGTH OF THREAD AND LENGTH OF TAPER AT TOP							.41	.62	.63	.82	.83
LENGTH OF PERFECT THREAD							.19	.29	.30	.39	.40
OUTSIDE DIAMETER OF PERFECT THREAD							.405	.540	.675	.840	1.05
DEPTH OF THREAD							.029	.044	.044	.057	.057
OUTSIDE DIAMETER OF THREAD AT END OF PIPE							.398	.522	.656	.816	1.025
ROOT DIAMETER OF THREAD AT END OF PIPE							.334	.433	.568	.702	.911
TAPER OF THREAD PER INCH OF SCREW							$\frac{1}{32}$	$\frac{1}{32}$	$\frac{1}{32}$	$\frac{1}{32}$	$\frac{1}{32}$
SIZE OF TAP DRILL							$\frac{11}{64}$	$\frac{11}{64}$	$\frac{11}{64}$	$\frac{11}{64}$	$\frac{11}{64}$
337.72	2526.	.003	.024	.106	14.200	9.431	$\frac{1}{8}$				
185.096	1383.8	.005	.045	.141	10.494	7.074		$\frac{1}{4}$			
100.785	754.36	.009	.082	.177	7.748	5.059			$\frac{3}{8}$		
63.322	473.91	.015	.131	.220	6.141	4.547				$\frac{1}{2}$	
36.116	270.03	.027	.230	.275	4.636	3.638					$\frac{3}{4}$
22.280	166.62	.044	.374	.344	3.641	2.905					
12.867	96.275	.077	.647	.434	2.768	2.301					
9.454	70.733	.105	.881	.497	2.372	2.010					
5.736	42.913	.174	1.453	.622	1.848	1.608					
4.020	30.077	.248	2.073	.753	1.547	1.329					
2.593	19.479	.384	3.201	.916	1.145	1.091					
1.947	14.565	.513	4.281	1.047	1.077	.955					
1.512	11.312	.661	5.512	1.178	.949	.849					
1.207	9.030	.828	6.905	1.309	.848	.764					
.961	7.197	1.039	8.662	1.456	.757	.687					
.666	4.984	1.500	12.510	1.734	.630	.577					
.496	3.717	2.012	16.774	1.996	.544	.501					
.384	2.878	2.598	21.662	2.258	.479	.443					
LENGTH OF PIPE IN FEET CONTAINING ONE U. S. GALLON	LENGTH OF PIPE IN FEET CONTAINING ONE CUBIC FOOT	U. S. GALLONS CONTAINED IN ONE LINEAL FOOT OF PIPE	POUNDS OF WATER CONTAINED IN ONE LINEAL FOOT OF PIPE	SQUARE FEET OF OUTSIDE OR RADIATING SURFACE PER LIN. FT. PIPE	LENGTH OF PIPE IN FEET PER SQUARE FOOT INSIDE SURFACE	LENGTH OF PIPE IN FEET PER SQUARE FOOT OUTSIDE OR RADIATING SURFACE	.055	.055	.055	.085	.11
							.068	.088	.091	.109	.11
							.205	.294	.421	.542	.73
										.244	.42
							.19	.29	.30	.39	.40

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WROUGHT PIPE DATA

11¼	11½	11½	8	8	8	8	8	8	8	8	8	ACTUAL OUTSIDE DIAMETER
6.21	6.33	6.67	7.12	7.60	8.00	8.40	8.80	9.28	10.08	10.88	11.68	ACTUAL INSIDE DIAMETER
1.06	1.07	1.10	1.64	1.70	1.75	1.80	1.85	1.91	2.01	2.11	2.21	OUTSIDE AREA
.54	.55	.58	.89	.95	1.00	1.05	1.10	1.16	1.26	1.36	1.46	INSIDE AREA
1.66	1.90	2.37	2.87	3.50	4.00	4.50	5.00	5.56	6.62	7.62	8.62	
.069	.069	.069	.100	.100	.100	.100	.100	.100	.100	.100	.100	
1.627	1.866	2.339	2.818	3.443	3.938	4.43	4.93	5.48	6.54	7.54	8.53	
1.488	1.728	2.201	2.618	3.243	3.738	4.233	4.73	5.28	6.34	7.34	8.33	
1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	4 1/2	5	6	7	8	

.405	.269	.129	.057										
.540	.364	.229	.104										
.675	.493	.358	.19										
.840	.622	.554	.30										
1.050	.824	.866	.53										
1.315	1.049	1.358	.86										
1.660	1.380	2.164	1.49										
1.900	1.610	2.835	2.03										
2.375	2.067	4.430	3.35										
2.875	2.469	9.492	4.77										
3.500	3.068	9.621	7.39										
4.000	3.548	12.566	9.88										
4.500	4.026	15.904	12.73										
5.000	4.506	19.635	15.94										
5.563	5.047	24.306	20.06										
6.625	6.065	34.472	28.89										
7.625	7.023	45.664	38.73										
8.625	7.981	58.426	50.0										

5	.225	.27	.36	.575	.755	.95	1.08	1.30	1.45	1.88	2.35	2.82	PRICE OF
3	.140	.145	.154	.203	.216	.226	.237	.247	.258	.280	.301	.322	TH
1	1.272	1.494	1.933	2.315	2.892	3.358	3.818	4.280	4.813	5.751	6.625	7.625	ACTUAL INSIDE D
7	.884	1.088	1.491	1.755	2.284	2.716	3.136	3.564	4.063	4.875	5.875	6.875	ACTUAL INSIDE DIAME
	.54	.55	.58	.89	.95	1.00	1.05	1.10	1.10	1.26	1.36	1.46	—INCHES—TOTAL DIST

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Length of Pipe in ft.	
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Table for Proportioning Single Pipe Steam Mains

Square Feet Radiation	TOTAL LENGTH OF MAIN IN FEET						
	20	40	75	100	150	200	Return
	Diam., Inches	Diam., Inches	Diam., Inches	Diam., Inches	Diam., Inches	Diam., Inches	Diam., Inches
100	1½	1½	1½	1½	1½	2	1
200	1½	1½	2	2	2	2	1¼
300	2	2	2	2	2	2½	1¼
400	2	2	2½	2½	2½	2½	1¼
500	2½	2½	2½	3	3	3	1¼
600	2½	3	3	3	3	3½	1½
700	2½	3	3	3	3½	3½	1½
800	3	3	3	3	3½	3½	1½
1000	3	3½	3½	3½	3½	4	2
1200	3½	4	4	4	4	4	2
1400	3½	4	4	4	4	5	2
1600	4	4	4	5	5	5	2½
1800	4	5	5	5	5	5	3
2000	4	5	5	5	5	6	3
2500	5	5	5	5	6	6	3
3000	5	5	6	6	6	6	3
3500	5	6	6	6	6	7	3
4000	6	6	6	7	7	7	3½
5000	7	7	7	8	8	8	4
6500	8	8	8	9	9	9	5

Reduce all radiating surface to equivalent indirect surface.

To Determine Boiler Capacity Required to Heat Swimming Pool

L x W x D equals cubic feet. Where L equals the length of the pool in feet, W equals the width and D equals the average depth of the water.

From table, page 228, determine the number of pounds per cubic foot at initial temperature of the water. This quantity multiplied by the number of cubic feet gives the number of pounds of water to be heated.

Pounds of water multiplied by the difference between initial and final temperature equals B. T. U. to be supplied, and dividing by the number of hours allowed for heating gives number of B. T. U. required to be supplied per hour.

Divide B. T. U. required per hour by 150 to determine rating of water boiler, or by 240 to determine rating of steam boiler.

Note.—If quantity of water is given in gallons multiply by 8⅓ (approximately 8⅓ pounds to the gallon) to reduce it to pounds.

Expansion of Wrought-Iron Pipe on the Application of Heat

Temp. Air When Pipe is Fitted	Increase in Length in Inches per 100 Feet When Heated to							
Deg. F.	160	180	200	212	220	228	240	274
0	1.28	1.44	1.60	1.70	1.76	1.82	1.92	2.19
32	1.02	1.18	1.34	1.44	1.50	1.57	1.66	1.94
50	.88	1.04	1.20	1.30	1.36	1.42	1.52	1.79
70	.72	.88	1.04	1.14	1.20	1.26	1.36	1.63

Table of Mains and Branches

Main	Branch				
1 -in. will supply 2	.....	.....	.....	.....	¾-in.
1¼-in. will supply 2	.....	.....	.....	.....	1 -in.
1½-in. will supply 2	.....	.....	.....	.....	1¼-in.
2 -in. will supply 2	.....	.....	.....	.....	1½-in.
2½-in. will supply 2	1½-in. and 1	1¼-in. or 1	2 -in. and 1		1¼-in.
3 -in. will supply 1	2½-in. and 1	2 -in. or 2	2 -in. and 1		1½-in.
3½-in. will supply 2	2½-in. or 1	3 -in. and 1	2 -in. or 3		2 -in.
4 -in. will supply 1	3½-in. and 1	2½-in. or 2	3 -in. or 4		2 -in.
4½-in. will supply 1	3½-in. and 1	3 -in. or 1	4 -in. and 1		2½-in.
5 -in. will supply 1	4 -in. and 1	3 -in. or 1	4½-in. and 1		2½-in.
6 -in. will supply 2	4 -in. and 1	3 -in. or 4	3 -in. or 10		2 -in.
7 -in. will supply 1	6 -in. and 1	4 -in. or 3	4 -in. and 1		2 -in.
8 -in. will supply 2	6 -in. and 1	5 -in. or 5	4 -in. and 2		2 -in.

Table Showing the Pounds of Magnesia Cement Necessary to Cover Fittings

Pipe Size Inches	Regular Ells			Long Radius Ells and Tees			Std. Flanged Joint		Extra Heavy Flange		Globe Valve		
	1″	2″	3″	1″	2″	3″	1″	2″	2″	3″	1″	2″	3″
1	.4	1.2	2.5	.8	2.0	4.0	2.0	9.7	9.7	20.	1.5	3.0	6.
1¼	.5	1.4	2.8	.9	2.2	4.5	2.1	10.1	10.1	21.	1.7	3.5	6.5
1½	.6	1.7	3.3	1.0	2.7	5.0	2.2	10.6	10.5	22.	2.0	4.0	7.
2	1.0	2.2	4.	1.2	3.2	6.0	2.7	11.5	11.5	23.3	2.8	5.	8.5
2½	1.2	2.8	5.	1.7	4.	7.4	3.2	12.5	12.7	25.	3.2	6.	9.7
3	1.4	3.2	6.	2.0	5.	8.7	3.6	13.5	14.3	27.	4.0	7.2	11.3
3½	1.7	4.	7.	2.5	5.8	10.2	4.	14.3	16.	28.	4.8	8.3	13.0
4	2.0	4.8	8.2	3.0	7.	12.	4.3	15.2	17.5	30.	5.4	9.4	14.5
4½	2.4	5.6	9.6	3.4	8.	13.4	4.7	16.	19.	33.	6.2	10.6	16.5
5	2.8	6.3	11.	4.0	9.	15.2	5.	17.	20.6	35.	7.0	12.	19.
6	3.6	8.	13.3	4.3	12.	19.5	6.	19.	24.	40.	8.2	15.	23.5
7	4.3	9.5	15.8	6.7	14.6	24.5	7.	21.	27.	45.	10.0	17.8	29.
8	5.	11.	18.3	8.1	17.	29.3	7.8	22.7	30.2	50.	11.5	20.8	34.5
9	6.3	14.	22.2	9.7	21.5	35.0	8.6	24.6	33.3	55.	13.0	25.2	41.
10	7.6	16.	26.	11.6	25.5	41.	9.3	21.5	36.6	60.	14.5	30.	48.
12	10.0	21.	33.8	16.0	34.0	55.	11.	30.	43.	70.	18.5	39.	62.

NOTE.—For Standard Cross add 25 per cent to the amount required for a Long Radius Elbow.

For No. 102 Asbestos Cement multiply the above quantity by two, and for No. 3 Asbestos Cement multiply by 2½.

The amount given does not include flanges. The valves used as a basis of computation are standard globe valves and are assumed to be covered to the flange by which the valve is dismounted in order to get at the valve seat.

Flange joints are assumed to be covered in accordance with the following rules:

1. The pipe covering itself is cut back from the flanges sufficient to take out the bolts and this cut-back is made on both sides so that the flange may be bolted up in either direction.

2. This cut-back is beveled out to the outside of the covering at 45°.

3. The flange joint cover is taken to be of rectangular axial section, the inside of the end walls extending to the limit of the pipe covering cut out for the flange bolts. The outside diameter of the flange cover is assumed to clear the flange by ¼ inch.

4. The flange joint cover is of the same thickness as the adjacent pipe covering.

Taken from the Franklin Manufacturing Co. catalogue by permission.

Combustion

COMBUSTION as used in steam engineering signifies a rapid chemical combination between oxygen and the carbon, hydrogen and sulphur composing the various fuels. This combination takes place usually at high temperature with evolution of light and heat. The substance combining with the oxygen is known as combustible and if it is completely burned the resultant gas is carbon dioxide (CO_2). If the combustion is imperfect carbon monoxide (CO) is formed. The temperature at which the reaction begins to take place is known as the kindling temperature and is different for each combustible. The following values are from Stromeyer:

Kindling Temperatures

Lignite Dust	300F.
Dried Peat	435F.
Sulphur	470F.
Anthracite Dust	570F.
Coal	600F.
Coke	Red heat
Anthracite	Red heat—750
Carbon Monoxide	Red heat—1211
Hydrogen	1030—1290

A flue gas analysis gives the proportion by volume of the principal constituent gases produced by the combustion of any fuel. The gases usually determined in such an analysis are carbon dioxide (CO_2), oxygen (O), and carbon monoxide (CO), while the residue or volume remaining after these gases are removed is taken as nitrogen. Carbon monoxide is very difficult to determine and may be present when not indicated by an Orsat apparatus.

Complete combustion of 1 pound of pure carbon will give a resultant gas containing 20.91% CO_2 and 79.09% N., the oxygen having all entered into combination with the carbon and the new gas resulting has simply taken the place of the original 20.91% oxygen. Now if 50% excess air is supplied only ⅔ of the original oxygen volume will be replaced by CO_2 and the flue gas analysis will show 13.91% CO_2, 7% oxygen and 79.91% nitrogen.

Air Required For Combustion

The calculations of the theoretical amount of air required for combustion presupposes that each and every particle of oxygen can be brought into intimate contact with the combustible. Practically this is impossible, due to the large amount of inert nitrogen present, variations in fuel bed, and interference of clinkers and ash, which cannot be removed as soon as formed. It is, therefore, necessary to provide for an excess of air when burning coal under natural draft, amounting to approximately 50% to 100% of the theoretical amount, or about 18 to 24 lbs. per pound of coal.

Less air results in imperfect combustion and smoke, while an excess cools the fire and boiler and carries away large quantities of heat in the flue gases. Harding & Willard give the following table of theoretical quantities of air required per pound of fuel as a basis for comparison:

Combustion—Continued

Fuel	Composition By Weight			Lbs. of Air Per Lb. of Fuel
	%C	%H	%O	
Wood Charcoal	93			11.16
Peat Charcoal	80			9.6
Coke Charcoal	94			10.8
Anthracite Coal	91.5	3.5	2.6	11.7
Bituminous Coal, Dry	87	5.0	4.–	11.6
Lignite	70	5.0	20.–	8.9
Peat, Dry	58	6.0	31.–	7.68
Wood, Dry	50	6.0	43.5	6.00
Mineral Oil	85	13.–	1.–	1.43

A large grate area and an insufficient draft are a bad combination because it is impossible to maintain good combustion over the entire area of the grate.

One pound of carbon in burning to CO_2 requires 2.66 pounds of oxygen or $2.66 \div 0.2315 = 11.52$ pounds of dry air. 0.2315 is the percentage of oxygen by weight in one pound of air. It may be shown in a similar manner that one pound of hydrogen requires 34.56 pounds of dry air, $8 \div 0.2315 = 34.56$. One pound of sulphur requires 4.32 pounds of dry air, $1 \div 0.2315 = 4.32$. Since the combustible portion of all commercial fuels consists chiefly of carbon, hydrogen and sulphur, the theoretical air requirements may be approximated from the fuel analysis as follows:

$$A = 11.52\,C + 34.56\left(H - \frac{O}{8}\right) + 4.32\,S, \text{ in which}$$

A = Weight of dry air required per pound of fuel, pounds.
C, H, O and S = Proportional part of dry weight of carbon, hydrogen, oxygen and sulphur in the fuel.

$\frac{O}{8}$ = Proportional part of the hydrogen supplied with oxygen from the fuel itself.

The above equation is commonly written:

$$A = 34.56\left\{\frac{C}{3} + \left(H - \frac{O}{8}\right) + \frac{S}{8}\right\}$$

The following example shows the application of the above formula:

Given—	Per Cent
Carbon	80
Hydrogen	4
Oxygen	3
Sulphur	1.5
Moisture	5
Non-combustible	6.5

Combustion—Continued

Calculation—

Substituting the values of C, H, O and S in the equation

$$A = 11.52 \times 0.80 + 34.56 \left(0.04 - \frac{0.03}{8}\right) + 4.32 \times 0.015 = 10.5$$

pounds, the theoretical weight of dry air necessary to burn one pound of coal as fired.

Since the coal contains 5 per cent of moisture, the weight of dry air required to burn one pound of dry coal of the given analysis =

$$\frac{10.5}{0.95} = 11.08$$

As water is treated as incombustible, the total incombustible in the analysis becomes 11.5 per cent. Therefore, the air required per pound of combustible is

$$\frac{10.5}{88.5} = 11.87 \text{ pounds.}$$

Chimneys

Draft is the difference in pressure which causes the flue gases to rise in a chimney. If the gas inside a stack be heated, each cubic foot of it will expand, hence its weight will be less than a cubic foot of colder outside air or gas. Therefore the unit pressure at the base of the chimney, due to the column of heated gas, will be less than that due to a column of cold air or gas of the same height on the outside of the chimney.

A chimney having height H is filled with gas at temperature t_2. If the chimney had sufficient additional height filled with hot gas at temperature t_2, added to the column in the chimney, this heated gas would just balance a column of air of equal cross section at temperature t_1 and height H. In practice this additional column of hot gas is lacking, hence the above system is unbalanced and the flow occurs into the base of chimney in virtue of the difference in head.

This difference in pressure, like the difference in head of water causes a flow of cold air or gas into the base of the chimney. If, just at the point of entrance into the chimney the cold incoming air is warmed up to the chimney temperature, the chimney will always be full of hot gas and the draft action will be continuous.

The difference in pressure or intensity of draft is usually measured in inches of water by means of a U-tube water gauge.

As draft measurements are taken along the path of the gases, the intensity grows less as the points at which the readings are taken are farther from the stack until in the boiler ashpit, with the ashpit doors open for freely admitting the air, there is little or no perceptible rise in the water of the gauge. The breeching, the boiler damper, the boiler flues and the coal on the grates—all retard the passage of the gases and the draft from the chimney is required to overcome the resistance offered by these various factors. The draft in the smoke hood may be 0.2 inches, while in the firebox it may be not over 0.08, the difference being the draft required to overcome the resistance offered in forcing the gases through the boiler.

Combustion—Continued

One of the most important factors to be considered in determining the loss of draft is the pressure required to force the air for combustion through the bed of fuel on the grates. This pressure will vary with the nature of the fuel used.

The theoretical velocity of the flue gases rising in the chimney may be determined from the table page 197, assuming an average draft intensity of 0.003 inches of water per foot of chimney.

It is found in practice that the above theoretical velocity is never obtained due to friction and other causes. William Kent assumes a layer of gas two inches in thickness as lining the chimney and reducing its effective area by that amount. In this case the calculated velocity should be assumed to be effective over the net area remaining, giving chimney efficiencies varying from 25 to 50 per cent, the lower velocities being obtained on small residence flues and the higher velocities on large flues.

Intensity of draft determines the velocity of flow through chimney but cross sectional area must be sufficient to pass the necessary volume of gas if the chimney is to have proper capacity. When the amount of air required for combustion is determined and the intensity of draft is known, the required cross sectional area can be calculated. An actual case is given below:

Given data:

10.3 pounds of coal burned per hour.
450° smoke hood temperature.
35 ft. height of chimney.

Calculation:

Assume the actual amount of air required for combustion one hundred per cent more than the theoretical, or 24 pounds of air per pound of coal.

$$\frac{10.3 \times 24 = 3{,}063 \text{ cu. ft. per hour at } 32°}{0.0807}$$

0.0807 equals weight of gas or air per cubic foot at 32°. Since volume of gas increases in proportion to absolute temperature, the following correction must be made.

$$3{,}063 \times \frac{910}{492} = 5{,}665 \text{ cu. ft. of flue gas which chimney must receive at smoke hood temperature.}$$

Where $910 = 460° + 450°$ and $492 = 460° + 32°$. 460 being the number of degrees it is necessary to add to the Fahrenheit temperature scale to give absolute temperatures.

$0.003 \times 35 = 0.105$ draft in inches of water.

Velocity corresponding to a draft of 0.105 inches of water determined from table page 197 is 15.36 feet per second.

$15.36 \times 3600 \times 0.25 = 13{,}825$—velocity of gases in feet per hour where 25% is the assumed efficiency of the chimney.

Combustion—Continued

the house in preference to extending outside. This is for the reason that the heat radiating from the chimney reduces the intensity of draft.

Short bends for offsets should be avoided.

Enlargement at base or increased cross sectional area of chimney should be avoided.

Chimney caps should not restrict the area. If extension or patent draft accelerators are used, they should have a free area equal to the area of the chimney.

If the flue is tile lined the joints must be well cemented or all space between the tile and brick work filled in tightly.

If the flue is made of brick the outside walls should be at least 8 inches thick to insure safety. The inside joints should be well struck, each course should be well bedded and free from surface mortar at the joints. The exposed brick at the top of chimney should be laid in cement mortar to prevent cutting out of the joints.

Cement Block chimneys having flues of single blocks have in most cases given insufficient draft. The outside walls of flues are only 2 inches to 2½ inches thick and cause chilling of inside air. Then, too, the difference in inside and outside temperature because of block construction causes the thin walls to check or crack a number of times in each block, allowing air leakages. Usually a coarse mixture is used for body of block and only a fine thin mixture for outside facing. This also permits air leakage.

The boiler flue should have no other openings either above or below the boiler smoke pipe, special care being exercised at the base of the flue to prevent any connection between it and the soot pocket of any other flue.

If the chimney contains more than one flue the dividing wall must be carried from the bottom to the top so that each flue is independent of the other throughout its entire length.

When tile linings are used the net inside area should be considered as the size of the chimney flue.

Long smoke pipes should be avoided wherever possible. When they are necessary great care should be taken to see that joints are made tight. Where the smoke pipe fits the smoke hood and enters the chimney the joints should be made tight with boiler putty or asbestos cement.

In case it is necessary to have a long smoke pipe from the heater to the chimney, great care is necessary to prevent loss of heat. Such a smoke pipe should be one or two inches larger than regular and should have an upward grade to chimney. It should have a good coating of asbestos covering, and there should be as few turns in the pipe as possible.

Combustion—Concluded

Smoke pipe should not extend into the flues beyond the inside surface of the lining, otherwise the end of the pipe cuts down the area of the flue.

Round tile linings are rated by inside dimensions. Rectangular linings are rated by outside dimensions.

Fire Clay Flue Linings

Nominal Size Inches	Actual Outside Inches	Actual Inside Inches	Area Square Inches	Weight per 1 ft. Lbs.
		Rectangular		
7 x 7	7¼ x 7¼	5¾ x 5¾	33.07	15
8½ x 8½	8½ x 8½	7¼ x 7¼	52.6	20
8½ x 13	8½ x 13	6⅞ x 11⅝	79.9	29
13 x 13	13 x 13	11¼ x 11¼	126.6	42
13 x 18	13 x 18	10¾ x 15¾	169.3	58
18 x 18	18 x 18	15½ x 15½	240.2	74
		Round		
7	8½	7	38.48	16
8	9	8	50.26	22
9	10½	9	63.61	26
10	12	10	78.54	30
12	14	12	113.1	45
15	17⅛	15	176.71	60
18	20⅞	18	254.47	80
20	23	20	314.16	90
24	27	24	452.39	130
30	35	30	706.86	230

ROBINSON CLAY PRODUCTS COMPANY.

Size of Round Chimneys Equivalent to Commercial Unlined Brick Flues and Flues with Tile Lining

Round Chimney Diameter Inches	Brick Flue Unlined Equivalent Size, Inches	Tile Flue Lining Equivalent Commercial *Size, Inches	Round Chimney Diameter Inches	Brick Flue Unlined Equivalent Size, Inches
8.5	8x 8			
9.		8½x13	20	16x20
11.	8x12		21	20x20
11.3		13 x13	24	20x24
13.	12.12		25	24x24
13.4		13 x18	28	24x28
15.	12x16		30	28x28
15.5		18 x18	33	28x32
17.	16x16		34	32x32

The actual inside dimensions of unlined brick flues are larger than the commercial size.

Fuels

FUELS are generally classified as solid, liquid, and gaseous.

Solid fuels are coal, wood, and wastes.

Liquid fuels are petroleum, and its products.

Gaseous fuels are natural and artificial gas.

The formation of coal is briefly described in "Steam," Babcock and Wilcox Co., as follows:

"All coals are of vegetable origin and are the remains of prehistoric forests. Destructive distillation, due to great pressures and temperatures, has resolved the organic matter into its invariable ultimate constituents, carbon, hydrogen, oxygen and other substances, in varying proportions. The factors of time, depth of beds, disturbance of beds and the intrusion of mineral matter resulting from such disturbances have produced the variation in the degree of evolution from vegetable fiber to hard coal. This variation is shown briefly in the content of carbon, and Table 1 shows the steps of such variation.

Composition of Coal

"The uncombined carbon in coal is known as fixed carbon. Some of the carbon constituent is combined with hydrogen and this, together with other gaseous substances driven off by the application of heat, form that portion of the coal known as volatile matter. The fixed carbon and the volatile matter constitute the combustible. The oxygen and nitrogen contained in the volatile matter are not combustible, but custom has applied this term to that portion of the coal which is dry and free from ash, thus including the oxygen and nitrogen."

Table 1

Approximate Chemical Changes from Wood Fiber to Anthracite Coal

Substance	Carbon	Hydrogen	Oxygen
Wood Fiber	52.65	5.25	42.10
Peat	59.57	5.96	34.47
Lignite	66.04	5.27	28.69
Earthy Brown Coal	73.18	5.68	21.14
Bituminous Coal	75.06	5.84	19.10
Semi-Bituminous Coal	89.29	5.05	5.66
Anthracite Coal	91.58	3.96	4.46

Fuels—Continued

Table 2

A NEW classification of American coals by Wm. Kent, based on the proximate and ultimate analyses and heating values of 155 coals from different States selected from the analyses of over 3,000 coals published in Bulletin 22 of the U. S. Bureau of Mines is as follows:

Classification and Heating Value of Coals

	Volatile Matter Per Cent of Combustible	Oxygen in Combustible Per Cent	Moisture in Air Dry Coal Free from Ash Per Cent	B. T. U. Per Lb. Combustible	B. T. U. Per Lb. Coal Air Dry Ash Free
1 Anthracite.....	less than 10	1 to 4	less than 1.8	14800 to 15400	14600 to 15400
2 Semi-anthracite..	10 to 15	1 to 5	less than 1.8	15400 to 15500	15200 to 15500
3 Semi-bituminous.	15 to 30	1 to 6	less than 1.8	15400 to 16050	15300 to 16000
4 Cannel*.....	45 to 60	5 to 8	less than 1.8	15700 to 16200	15500 to 16050
5 Bituminous, High Grade.....	30 to 45	5 to 14	1 to 4	14800 to 15600	14350 to 15500
6 Bituminous, Medium Grade	32 to 50	6 to 14	2.5 to 6.5	13800 to 15100	13400 to 14400
7 Bituminous, Low Grade.....	32 to 50	7 to 14	5 to 12	12400 to 14600	11300 to 13400
8 Sub-bituminous and Lignite...	27 to 60	10 to 33	7 to 26	9600 to 13250	7400 to 11650

*Eastern cannel. The Utah cannel is much lower in heating value.

The non-combustible constituents are the ash and moisture, the former varying from 3% to 30% and the latter from 0.75 to 25% of the total weight, depending on grade and locality where mined. A large percentage of ash is undesirable as it not only reduces the calorific value of the fuel, but chokes up the air passages in the boiler and through the fuel bed, thus preventing the rapid combustion necessary to high efficiency. If the coal contains an excessive quantity of sulphur, trouble will result from its harmful action on the metal of the boiler where moisture is present, and because it unites with the ash to form a fusible slag or clinker which will choke up the grate bars and form a solid mass in which large quantities of unconsumed carbon may be imbedded.

Moisture in coal may be more detrimental than ash in reducing the temperature of a furnace, as it is non-combustible, absorbs heat both in being evaporated and superheated to the temperature of the boiler gases. In some instances, however, a certain amount of moisture in a bituminous coal produces a mechanical action that assists in the combustion and makes it possible to develop higher capacities than with dry coal.

General characteristics of hard and soft coals. The former contain fixed or uncombined carbon in large proportion, whereas the latter have an increasing percentage of carbon in combination with hydrogen, or hydrocarbon which is volatile, and will distill off under high temperature, producing smoke. Hard coal usually contains more ash, especially in the smaller sizes.

Fuels—Continued

Anthracite or hard coal ignites slowly, but when in a state of incandescence its radiant heat is very great. Its flame is very short and of a yellowish blue tinge and it can be burned with practically no smoke. This coal does not swell when burned although it contains from 3 to 7.5% of volatile matter.

True or dry anthracite is characterized by few joints and clefts, and their squareness; great relative hardness and density; high specific gravity, ranging from 1.4 to 1.8 and semi-metallic luster.

Anthracite is classed and marketed according to graded sizes as follows:

Table 3

Names and Sizes of Anthracite or "Hard" Coal

Names of Sizes	Will Pass Through		Will Not Pass Through	
Grate	4 " square	4½" round	2¾" square	3⅛" round
Egg	2¾" "	3⅛" "	2 " "	2¼" "
Stove	2 " "	2¼" "	1⅜" "	1 9/16" "
Nut	1⅜" "	1 9/16" "	¾ " "	⅞" "
Pea	¾" "	⅞" "	½" "	9/16" "
Buckwheat	½" "	9/16" "	¼" "	5/16" "
Rice	¼" "	5/16" "	⅛" "	3/16" "
Barley	⅛" "	3/16" "		3/32" "

The anthracite coals are, with some unimportant exceptions, confined to five small fields in Eastern Pennsylvania.

Semi-Anthracite coal kindles more readily, due to its higher content of volatile combustible, and burns more rapidly than anthracite. It has less density, hardness and metallic luster than anthracite, and the average specific gravity is about 1.4.

This coal is found in the western part of the anthracite field in a few small areas.

Semi-Bituminous coal is softer than anthracite or semi-anthracite, contains more volatile hydrocarbon and will kindle more easily and burns more rapidly. It is usually free burning and due to its high calorific value very desirable for steam generation purposes.

This coal is found in Pennsylvania, Maryland, Virginia, W. Virginia and Tennessee.

Bituminous coals are still softer than those described and contain still more of the volatile hydrocarbons. The difference between the semi-bituminous and the bituminous coals is an important one, economically. The former have an average heating value per pound of combustible about 6 per cent higher than the latter, and they burn with much less smoke in ordinary boilers. The distinctive characteristic of the bituminous coals is the emission of yellow flame and [illegible] burning. In color they range from pitch black to dark

Fuels—Continued

brown, having a resinous luster in the most compact specimens, and a silky luster in such specimens as show traces of vegetable fiber. The specific gravity is ordinarily about 1.3.

Bituminous coals are either of the caking or non-caking class. The former, when heated, fuse and swell in size; the latter burn freely, do not fuse, and are commonly known as free burning coals. Caking coals are rich in volatile hydrocarbons and are valuable in gas manufacture.

Bituminous coals absorb moisture from the atmosphere. The surface moisture can be removed by ordinary drying, but a portion of the water can be removed only by heating the coal to a temperature of about 250 degrees Fahrenheit.

Table 4

Names and Sizes of Bituminous or "Soft" Coal

For "Domestic" soft coals there are no uniform names and sizes; but they are marketed in the various states under about these classes:

"Screenings" usually smallest sizes.

"Duff" goes through ⅛ in. screen.

"No. 3 Nut" goes through 1¼ in. screen, over ¾ in. screen.

"No. 2 Nut" goes through 2 in. screen, over 1¼ in. screen.

"No. 1 Domestic Nut" goes through 3 in. screen, over 1½ or 2 in. screen.

"No. 4 Washed" goes through ¾ in. screen, over ¼ in. screen.

"No. 3 Washed Chestnut" goes through 1¼ in. screen, over ¾ in. screen.

"No. 2 Washed Stove" goes through 2 in. screen, over 1¼ in. screen.

"No. 1 Washed Egg" goes through 3 in. screen, over 2 in. screen.

"No. 3 Roller Screened Nut" goes through 1½ in. screen, over 1 in. screen.

"No. 2 Roller Screened Nut" goes through 2 in. screen, over 1½ in. screen.

"No. 1 Roller Screened Nut" goes through 3½ in. screen, over 2 in. screen.

"Egg" goes through 6 in. over 3 in. screen.

"Lump" or "Block" goes through 6 in. screen, or over.

"Run-of-Mine" in fine and large lumps.

POCAHONTAS SMOKELESS: Generally sized as: "Nut," "Egg," "Lump," and "Mine-Run."

Bituminous Coals have been considered as a single class but vary greatly in heating value and in the amount of moisture remaining in air-dried coal, which is used as the basis by William Kent of subdividing into three classes:

Fuels—Continued

Bituminous High Grade Coals are found particularly in the Appalachian field in the States of Pennsylvania, West Virginia, Maryland, Virginia, Ohio, Kentucky, Tennessee and Alabama, a field nearly 900 miles in length. The coal mined in this field is mostly caking and is used extensively for steam purposes in the East.

Bituminous Medium Grade Coals are similar to the High Grade Coals but are mostly non-caking. They are found in the middle interior States such as Michigan, Illinois, Indiana, Iowa and Kansas.

Bituminous Low Grade Coal is found particularly in the Western States, in the Rocky Mountain region, such as Montana, New Mexico, Oklahoma and Utah.

Cannel Coal is a variety of bituminous coal, rich in hydrogen and hydrocarbons, and is exceedingly valuable as a gas coal. It has a dull resinous luster and burns with a bright flame without fusing. Cannel coal is seldom used for steam coal, though it is sometimes mixed with semi-bituminous coal, where an increased economy at high rates of combustion is desired. The composition of cannel coal is approximately as follows: Fixed carbon, 26 to 55 per cent; volatile matter, 42 to 64 per cent; earthy matter, 2 to 14 per cent. Its specific gravity is approximately 1.24.

Names and sizes of Cannel Coal: For fireplace—"Hand Picked Lump"; for stoves: "Egg."

Sub-Bituminous Coal sometimes called "black lignite" is organic matter in the earlier stages of its conversion into coal. Its specific gravity is low and when freshly mined it contains a high percentage of moisture. Its appearance is black with a pitchy luster resembling hard coal in the best varieties. It is non-caking and burns with a bright but slightly smoky flame with moderate heat. Its composition varies over wide limits. The ash may run as low as 1% and as high as 50%. Its high content of moisture and the large quantity of air necessary for its combustion cause large stack losses. It is distinctly a low-grade fuel and is used almost entirely in the districts where mined. It is found particularly in the Western Mountain States such as Montana, Wyoming and Utah.

Lignite is very similar to sub-bituminous coal and is distinguished from it not by analysis but by color, texture and disintegration. Its appearance is brown and has a distinctly woody structure. This fuel contains a high percentage of moisture and if exposed to the weather it rapidly disintegrates, which increases the difficulty of burning. It burns with a short, non-smoky flame similar to wood. Like the sub-bituminous coal it is a very low grade of fuel and is used only in a few localities where mined. Lignites resemble the brown coals of Europe and are found in the Western States, particularly in Texas and North Dakota.

Coke is a porous product consisting almost entirely of carbon remaining after certain manufacturing processes have distilled off the hydrocarbon gases of the fuel used. It is produced, first, from

Fuels—Continued

gas coal distilled in gas retorts; second, from gas or ordinary bituminous coals burned in special furnaces called coke ovens; and third, from petroleum by carrying the distillation of the residuum to a red heat.

Coke is a smokeless fuel. It readily absorbs moisture from the atmosphere and if not kept under cover its moisture content may be as much as 20 per cent of its own weight.

Gas-house coke is generally softer and more porous than oven coke, ignites more readily, and requires less draft for its combustion.

Names and sizes of Domestic By-Product Coke: "Egg" 3 in.—2½ in. "Large Stove" 2½ in—2 in. "Small Stove" 2 in.—1½ in. "Nut" 1½ in.—¾ in. "Pea" ¾ in.—1½ in.

The **analysis of a coal** should be ascertained if possible. The actual composition of any coal is determined by an **ultimate** chemical analysis, which can only be made by an experienced chemist.

The **ultimate analysis** of a fuel gives the percentage by weight of the various elements composing same. Such an analysis is usually reported on the dry sample as 100%, and the percentage of moisture in the original sample given separately.

The true analysis is easily obtained by dividing each reported percentage by 100 + % H_2O in original sample as indicated in the following:

Table 5

Constituent	Chemists Report (based on dry fuel)	True Analysis (fuel as received)
Carbon	76.71%	72.52 %
Hydrogen	5.07%	4.78 %
Oxygen	8.65%	8.156%
Nitrogen	1.16%	1.09 %
Sulphur	1.21%	1.14 %
Ash	7.00%	6.60 %
	100.00%	
Moisture	6.06%	5.714%
	106.06%	100.00%

The **proximate analysis** of a fuel gives the percentage by weight of the fixed carbon, volatile matter, moisture and ash.

The **heat of combustion or calorific value** of a fuel is the number of B. T. U. evolved when 1 pound of the fuel is completely burned in air or oxygen.

A **calorimeter** is used to determine the heat generated by the combustion of a known weight of the fuel, and this heat reduced to a pound basis. In the case of a solid or liquid fuel a **bomb calorimeter** is employed, and the standard apparatus in use at the present time is that devised by M. Pierre Mahler.

Fuels—Continued

TABLE 6
Composition and Heat Values of Anthracite Coals

Locality	Fixed Carbon	Volatile	Moisture	Ash	Sulphur	B. t. u. per Lb. of Dry Coal
Anthracite						
Pennsylvania	78.60	.....	.....	14.80	0.40	.....
Pennsylvania Buckwheat	81.32	3.84	3.88	10.96	0.67	12200
Pennsylvania, Wilkesbarre	76.94	6.42	1.34	15.30	.....	11801
Pennsylvania, Scranton	79.23	3.73	3.33	13.70	.....	12149
Pennsylvania, Scranton	84.46	5.37	0.97	9.20	.....	12294
Pennsylvania, Cross Creek	89.19	1.96	3.62	5.23	.....	13723
Pennsylvania, Lehigh Valley	75.20	7.36	1.44	16.00	.....	12423
Pennsylvania, Lykens Valley	76.94	6.21	.....	.....	.....	15300
Pennsylvania, Lykens Valley	81.00	5.00	.....	.....	.....	15300
Pennsylvania, Wharton	86.40	3.08	3.71	6.22	0.58	15000
Pennsylvania, Buck Mt	82.66	3.95	3.04	9.88	0.46	15070
Pennsylvania, Beaver Meadow	88.94	2.38	1.50	7.11	1.01	.....
Pennsylvania, Lackawanna	87.74	3.91	2.12	6.35	0.12	.....
Rhode Island	85.00	.....	.....	7.00	0.90	.....
Arkansas	74.49	14.73	1.52	9.26	.....	13217
Semi-Anthracite						
Pennsylvania, Loyalsock	83.34	8.10	1.30	6.23	1.03	15400
Pennsylvania, Bernice	82.52	3.56	0.96	3.27	0.24	15050
Pennsylvania, Bernice	89.39	8.56	0.97	9.34	1.04	15475
Pennsylvania, Wilkesbarre	88.90	7.68	.....	3.49	.....	14199
Pennsylvania, Lycoming Creek	71.53	13.84	0.67	13.96	0.03	.....
Virginia, Natural Coke	75.08	12.44	1.12	11.38	0.47	.....
Arkansas	74.06	14.93	1.35	9.66	.....	.....
Indian Territory	73.21	13.65	5.11	8.03	1.18	13662
Maryland, Easby	83.60	16.40	.....	.....	.....	11207

TABLE 7
Composition and Heat Values of Bituminous Coals

State	County	Fixed Carbon	Volatile Matter	Moisture	Ash	B. T. U.'s per Lb.
Alabama	Bibb	52.09	28.56	6.43	12.92	12395
	Jefferson	63.90	26.16	3.23	6.71	14074
Arkansas	Sebastian	66.57	16.27	5.47	11.69	12690
	Johnson	72.88	12.68	2.36	12.08	13259
	Ouachita	24.37	26.49	39.43	9.71	6356
Colorado	Boulder	40.45	34.88	18.68	5.99	10143
	Garfield	54.10	33.00	4.80	8.10	12060
	Las Animas	53.36	28.37	1.44	16.83	12726
Illinois	St. Clair	39.42	35.70	11.69	13.19	10699
	Saline	50.27	33.54	7.81	8.38	12418
	Williamson	46.59	32.26	8.20	12.95	11362
Indiana	Greene	46.20	32.07	13.58	8.15	11419
	Pike	42.75	35.03	10.57	11.65	11266
	Vigo	39.67	35.45	12.79	12.09	10899
Iowa	Lucas	41.49	30.49	15.39	12.63	10242
	Polk	35.17	36.94	13.88	14.01	10244
Kansas	Cherokee	51.25	33.80	2.50	12.45	12900
	Crawford	46.68	31.23	4.18	17.91	11642
Kentucky	Union	55.63	30.99	5.46	7.92	13239
	Ohio	49.28	32.63	8.04	10.05	10233

Fuels—Continued

TABLE 7 (Continued)

State	County	Fixed Carbon	Volatile Matter	Moisture	Ash	B. T. U.'s per Lb.
Missouri	Randolph	39.82	33.64	12.92	13.62	10548
	Miller	41.05	41.45	12.67	4.83	12487
Montana	Carbon	45.69	32.36	8.56	13.39	10685
	Gallatin	35.38	29.63	4.13	30.86	9095
Ohio	Belmont	49.45	37.61	2.97	9.97	12935
	Jackson	43.80	35.85	9.01	11.34	11495
Pennsylvania	Cambria	73.04	16.82	3.51	6.63	14279
	Fayette	58.29	27.87	5.13	8.71	13365
Utah	Carbon	47.06	42.02	6.05	4.87	13151
Virginia	Tazewell	75.34	17.17	1.63	5.86	14672
	Wise	60.82	31.65	3.05	4.48	14470
W. Virginia	Fayette	74.80	17.10	2.80	5.30	14701
	Marion	55.14	36.77	1.75	6.34	14107
Wyoming	Carbon	41.07	40.32	11.30	7.31	10755

From U. S. Bureau of Mines Bulletin No. 23.

The above valuations were obtained at St. Louis Testing Plant from 139 samples of coal. The heating values of the various coals were established by "actually burning one gram of the air-dried coal in oxygen in a Mahler-bomb calorimeter." These values in B. t. u. give the theoretical thermal value of soft coals for either high or low pressure heating.

The **oil fuels** have been briefly characterized in "Steam" as follows:

"**Petroleum** is practically the only liquid fuel sufficiently abundant and cheap to be used for the generation of steam. It possesses many advantages over coal and is extensively used in many localities.

"There are three kinds of petroleum in use, namely those yielding on distillation: 1st, paraffin; 2nd, asphalt; 3rd, olefine. To the first group belong the oils of the Appalachian Range and the Middle West of the United States. These are a dark brown in color with a greenish tinge. Upon their distillation such a variety of valuable light oils are obtained that their use as fuel is prohibitive because of price.

"To the second group belong the oils found in Texas and California. These vary in color from a reddish brown to a jet black and are used very largely as fuel.

"The third group comprises the oils from Russia, which, like the second, are used largely for fuel purposes.

"The light and easily ignited constituents of petroleum, such as naphtha, gasoline and kerosene, are oftentimes driven off by a partial distillation, these products being of greater value for other purposes than for use as fuel. This partial distillation does not

Fuels—Continued

decrease the value of petroleum as a fuel; in fact, the residuum known in trade as "fuel oil" has a slightly higher calorific value than petroleum and because of its higher flash point, it may be more safely handled. Statements made with reference to petroleum apply as well to fuel oil.

"In general, crude oil consists of carbon and hydrogen, though it also contains varying quantities of moisture, sulphur, nitrogen, arsenic, phosphorus and silt. The moisture contained may vary from less than 1 to over 30 per cent, depending upon the care taken to separate the water from the oil in pumping from the well. As in any fuel, this moisture affects the available heat of the oil, and in contracting for the purchase of fuel of this nature it is well to limit the per cent of moisture it may contain. A large portion of any contained moisture can be separated by settling and for this reason sufficient storage capacity should be supplied to provide time for such action."

The calorific values of petroleum range from 18,000 to 22,000 B. t. u. per pound, and the percentage composition and other data is given in Table 8. The **flash point** of crude oil is the temperature at which it begins to give off inflammable gases. This temperature varies greatly for different oils as shown in the table.

TABLE 8

Composition and Calorific Value of Various Oils

Kind of Oil	Per Cent Carbon	Per Cent Hydrogen	Per Cent Sulphur	Per Cent Oxygen	Spe. Gravity	Deg. Flash Point	B. t. u. Pound	Authority
#								
California	85.04	11.52	2.45	0.99*	.....	.....	17871	B. & W. Co.
California	81.52	11.51	0.55	6.92*	.....	230	18667	U. S. N. Liquid Fuel Board
Texas	87.15	12.33	0.32	.....	0.908	370	19388	U. S. N.
Texas	87.29	12.32	0.43	.....	0.910	375	19659	U. S. N.
Ohio	83.40	14.70	0.60	1.30	.....	.....	19580	.....
Pennsylvania	84.90	13.70	.....	1.40	0.886	.....	19210	Booth
West Virginia	84.30	14.10	.....	1.60	0.841	.....	21240	.....
Mexico	82.00	11.00	3.3	.....	.940	.....	18800	.....
Oklahoma	85.7	13.11	0.4	.....	.....	.....	19376	.....
Kansas Crude	84.15	13.00	1.9	.....	.866	.....	19000	.....
Shale	86.16	12.37	0.26	.....	.855	.....	18248	.....

*Includes N. #Per cent moisture = 1.40.

The **comparative value of petroleum and coal as fuel may** be summed up to the **advantage of the liquid fuel** as follows: The cost of handling is much lower, both in delivery and in burning same, while for equal heat value much less storage space is required, and this space may be at a distance from the boilers. Higher efficiencies are obtainable, since the combustion is more perfect, less excess air is required, temperatures are more constant, and since smoke is largely eliminated, the heating surfaces are correspondingly clean.

Fuels—Continued

The intensity of the fire can be instantly regulated to suit the load requirements, and there is no deterioration from loss of heat value by disintegration due to storage.

The **disadvantage of the liquid fuel** arises from the fact that the oil must have a reasonably high flash point to reduce the danger of explosion, and city ordinances may, in certain cases, make its use practically prohibitive. Due to high temperatures of the oil flame the boiler upkeep cost may be increased.

The **comparative evaporative power of coal and oil** is given in the table following.

TABLE 9

Evaporation of Water from Coal and Oil

Taken from the U. S. Geological Report on Petroleum for 1900.

1 Pound of Combustible	Pounds of Water Evaporated at 212° per Pound of Combustible	Barrels of Petroleum Required to Do Same Amount of Evaporation as 1 Ton of Coal Petroleum 18° to 40° Baume
Pittsburgh lump and nut, Penn. . .	10.0	4.0
Pittsburgh nut and slack, Penn. . .	8.0	3.2
Anthracite, Pennsylvania.	9.8	3.9
Indiana Block.	9.5	3.8
Georges Creek lump, Maryland. . .	10.0	4.0
New River, West Virginia.	9.7	3.8
Pocahontas lump, West Virginia. .	10.5	4.2
Cardiff lump, Wales.	10.0	4.0
Cape Breton, Canada.	9.2	3.7
Nanaimo, British Columbia.	7.3	2.9
Co-operative, British Columbia. . .	8.9	3.6
Greta, Washington.	7.6	3.0
Carbon Hill, Washington.	7.6	3.0

Under favorable conditions 1 pound of oil will evaporate from 14 to 16 pounds of water from and at 212°; 1 pound of coal will evaporate from 7 to 10 pounds of water from and at 212°; 1 pound of natural gas (21.9 cu. ft.) will evaporate from 18 to 20 pounds of water from and at 212°.

The burning of petroleum fuel or oil can only be accomplished in steam boiler practice by the use of suitable burners, which must atomize the oil so thoroughly that each particle will be brought in contact with the minimum quantity of air necessary for its complete

Fuels—Continued

combustion before the gases come in contact with any heating surfaces. No localization of the heat must occur at the heating surfaces or trouble will result from overheating and blistering.

The burners may be classified under three general types: 1st, **spray burners,** in which the oil is atomized by steam or compressed air; 2nd, **vapor burners,** in which the oil is converted into vapor and then passed into the fire box; 3rd, **mechanical burners,** in which the oil is atomized by submitting it to high pressure and passing it through a small orifice.

Natural gas has a limited use but is, of course, confined to restricted areas. The best results are secured by using a large number of small burners to which the gas is supplied at a pressure of about 8 ounces. The calculations for amount of gas required to give a certain heating effect should in all cases be based on volume reduced to standard conditions of temperature and pressure, namely 32° F. and 14.7 pounds per sq. in.

The variation in composition and heating value of natural gas is shown in the following table:

TABLE 10

Typical Analysis (By Volume) and Calorific Values of Natural Gas from Various Localities

Locality of Well	H	CH_4	CO	CO_2	N	O
Anderson, Ind...	1.86	93.07	0.73	0.26	3.02	0.42
Findlay, Ohio....	1.64	93.35	0.41	0.25	3.41	0.39
St. Ive, Pa.....	6.10	75.54	Trace	0.34	.....	.....
Pittsburgh, Pa...	9.64	57.85	1.00	.....	23.41	2.10
Pittsburgh, Pa...	20.02	72.18	1.00	0.80	.....	1.10

Locality of Well	Heavy-Hydro-Carbons	H_2S	B. t. u. per Cubic Foot Calculated*
Anderson, Ind.....	0.47	0.15	1017
Findlay, Ohio.....	0.35	0.20	1011
St. Ive, Pa.....	18.12	.....	1117
Pittsburgh, Pa.....	6.00	.....	748
Pittsburgh, Pa.....	4.30	.....	917

*B. t. u. calculated, using percentage of constituent gases, and separate heat values.

Fuels—Concluded

Analyses, Calorific Values, Weights and Coal Equivalents of Wood

Kind of Wood	Ultimate Analysis Dry Wood					B. t. u. per Pound Dry Wood	Lbs. per Cord Seasoned Wood	Cords Seasoned Wood Equivalent to One Ton Coal
	C	H	N	O	Ash			
Oak	50.16	6.02	0.09	43.36	0.37	8316	4500	1.15
Ash . . .	49.18	6.27	0.07	43.91	0.57	8480	3750	1.37
Elm . . .	48.99	6.20	0.06	44.25	0.50	8510	3500	1.44
Beech .	49.06	6.11	0.09	44.17	0.57	8591	4050	1.24
Birch . .	48.88	6.06	0.10	44.67	0.29	8586	4100	1.22
Fir	50.36	5.92	0.05	43.39	0.28	9063	2350	2.01
Pine . . .	50.31	6.20	0.04	43.08	0.37	9153	2500	1.87
Poplar .	49.37	6.21	0.96	41.60	1.86	7834	2600	2.12
Willow .	49.96	5.96	0.96	39.56	3.37	7926	2400	2.26

Wood when newly cut contains moisture varying from 30 per cent to 50 per cent. When dried for a period of one year this moisture content will be reduced to 18 per cent to 20 per cent. Wood that has been cut six months or more is termed "seasoned wood."

In computing the cords of seasoned wood equivalent to one ton of coal allowance was made for the increased moisture content and the lower efficiency at which wood is burned. A coal of 12500 B. t. u. was used in the computations.

Cost of Heating With Gas and Oil Compared With Coal

COAL Cost per short ton (1 lb.= 12500 B. t. u.)	GAS 1 cu. ft.=600 B. t. u. cost per thousand cu. ft.			GAS 1 cu. ft.=1000 B. t. u. cost per thousand cu. ft.			OIL 1 lb.=19000 B. t. u. cost per gallon		
Dollars	.30	.50	.70	.30	.50	.70	.06	.09	.12
3.00	4.17	5.55	9.72	2.50	4.17	5.83	3.44	5.15	6.87
4.00	3.12	5.21	7.29	1.88	3.12	4.37	2.57	3.86	5.14
5.00	2.50	4.17	5.83	1.50	2.50	3.50	2.06	3.09	4.12
6.00	2.08	3.47	4.86	1.25	2.08	2.92	1.72	2.58	3.44
7.00	1.79	2.98	4.17	1.07	1.78	2.50	1.47	2.21	2.95
8.00	1.56	2.60	3.65	.94	1.56	2.19	1.29	1.93	2.58
9.00	1.39	2.32	3.24	.83	1.39	1.94	1.15	1.72	2.29
10.00	1.25	2.08	2.92	.75	1.25	1.75	1.03	1.55	2.06
11.00	1.14	1.52	2.65	.68	1.14	1.59	.94	1.41	1.88
12.00	1.04	1.74	2.43	.63	1.04	1.46	.86	1.29	1.72
15.00	.83	1.11	1.94	.50	.83	1.16	.69	1.03	1.37

The above table is computed with the assumption that the efficiency of utilization is the same for coal, gas and oil.

For example, in comparing the heating cost of gas of 600 B. t. u. at 70 cents and coal at $9.00 per ton, it would cost 3.24 times as much to heat with gas as with coal.

If the operating efficiency of the boilers are unequal correction may be made by multiplying the table factor by the ratio of the efficiencies.

Average Weight of Coal

One cubic foot of hard coal weighs about . . . . . 50 pounds
One cubic foot of soft coal weighs about . . . . . 40 pounds
One cubic foot of coke weighs about . . . . . 28 pounds

Water

Pure water is a chemical compound formed by the union of t volumes of hydrogen gas with one volume of oxygen gas or two pa by weight of hydrogen and 16 parts by weight of oxygen. Wa expands when heated from 39.2° F., or temperature of maximu density, to any higher temperature, but contracts when heated fr 32° to 39.2° F. 62° F. is known as standard temperature.

At 62° a U. S. gallon equals 231 cubic inches and weighs appro mately 8 1-3 pounds. For engineering work it is sufficiently acc rate to assume a cubic foot as equal to 7.48 gallons.

At 62° F. the pressure in pounds per square foot—head in feet 62.36 pounds; or in pounds per square inch—the head in feet x 62. pounds divided by 144 or head in feet x 0.443 pounds. If the head given in inches of water, then the pressure in ounces per square in is the head divided by 12 x 62.36 divided by 144 x 16 or 1.73 x pre sure in ounces per square inch. A column of water 2.309 feet 27.71 inches high exerts a pressure of 1 pound per square inch 62°.

The specific volume is always the reciprocal of the specific densit (weight per cubic foot of water at the same temperature). Th weight per cubic foot is given in the table of "Heat Units in Water."

Boiling Point of Water at Various Altitudes

Boiling Point Degrees Fahr.	Altitude Above Sea Level Ft.	Atmospheric Pressure Pounds per Sq. In.	Barometer Reduced to 30 Degrees Inches	Boiling Point Degrees Fahr.	Altitude Above Sea Level Ft.	Atmospheric Pressure Pounds per Sq. In.	Barometer Reduced to 32 Degrees Inches
184	15221	8.20	16.70	199	6843	11.29	22.90
185	14649	8.38	17.96	200	6304	11.52	23.47
186	14075	8.57	17.45	201	5764	11.76	23.95
187	13498	8.76	17.83	202	5225	12.01	24.45
188	12934	8.95	18.22	203	4697	12.26	24.96
189	12367	9.14	18.61	204	4169	12.51	25.48
190	11799	9.34	19.02	205	3642	12.77	26.00
191	11243	9.54	19.43	206	3115	13.03	26.53
192	10685	9.74	19.85	207	2589	13.30	27.08
193	10127	9.95	20.27	208	2063	13.57	27.63
194	9579	10.17	20.71	209	1539	13.85	28.19
195	9031	10.39	21.15	210	1025	14.13	28.76
196	8481	10.61	21.60	211	512	14.41	29.33
197	7932	10.83	22.05	212	Sea Level	14.70	29.92
198	7381	11.06	22.52				

Water—Continued

INCRUSTATION is a deposit that is formed on the inside of a boiler and is caused by impurities in the water that are left behind in the boiler. If the water used in a boiler were perfectly pure, there would be no trouble from incrustation. However, in passing through the soil, water dissolves certain mineral substances, the most important of which are carbonate of lime and sulphate of lime. A quantitative analysis can only be made by an expert chemist having a well equipped laboratory and the proper apparatus, but a test for the most common impurities can easily be made with the aid of chemicals procurable in almost any drug store. Such test will show the kind of impurities present, but will not show the amount.

To test water for carbonate of lime, pour some of the water to be tested into an ordinary tumbler, add a little ammonia and ammonium oxalate and heat to the boiling point. If carbonate of lime is present, a precipitate will be formed.

To test for sulphate of lime, pour some of the water into a tumbler, add a few drops of hydrochloric acid, add a small quantity of a solution of barium chloride and slowly heat the mixture. If a white precipitate is formed which will not redissolve when a little nitric acid is added, sulphate of lime is present.

Carbonate of lime will not dissolve in pure water, but will dissolve in water that contains carbonic acid gas. It becomes insoluble and is precipitated in solid form when the water is heated to about 212, the carbonic acid gas being driven off by the heat.

Sulphate of lime dissolves readily in cold water, but not in hot water. It precipitates in a solid form when the water is heated to about 290.

Sal ammoniac added to water containing carbonate of lime will cause the lime to precipitate, but its use is not recommended when caustic soda can be obtained. While slack lime will precipitate carbonate of lime, it will have no effect on sulphate of lime, and water containing the latter, either alone or in conjunction with carbonate of lime must be treated with other chemicals. The most available ones for water containing both are carbonate of soda and caustic soda. These are fed into the boiler and will precipitate the carbonate of lime and sulphate of lime, requiring the sediment to be blown out periodically.

Factors For Equivalent Evaporation

Temp. of Feed Water in Degrees F.	GAUGE PRESSURE—POUNDS						
	0	1	2	3	4	5	10
212	1.0000	1.0012	1.0019	1.0035	1.0046	1.0056	1.0100
209	1.0026	1.0043	1.0050	1.0066	1.0077	1.0087	1.0131
206	1.0057	1.0074	1.0081	1.0097	1.0108	1.0118	1.0162
203	1.0088	1.0105	1.0112	1.0128	1.0139	1.0149	1.0193
200	1.0119	1.0136	1.0143	1.0160	1.0170	1.0180	1.0225
197	1.0150	1.0167	1.0174	1.0191	1.0201	1.0212	1.0256
194	1.0181	1.0198	1.0205	1.0222	1.0232	1.0243	1.0287
191	1.0212	1.0229	1.0236	1.0253	1.0263	1.0273	1.0318
188	1.0243	1.0260	1.0267	1.0284	1.0294	1.0305	1.0349
185	1.0274	1.0291	1.0298	1.0315	1.0325	1.0336	1.0380
182	1.0305	1.0322	1.0329	1.0346	1.0356	1.0367	1.0411
179	1.0336	1.0353	1.0360	1.0377	1.0387	1.0397	1.0442
176	1.0367	1.0384	1.0391	1.0408	1.0418	1.0428	1.0473
173	1.0398	1.0415	1.0422	1.0439	1.0449	1.0459	1.0504
170	1.0429	1.0446	1.0453	1.0470	1.0480	1.0491	1.0534
167	1.0460	1.0477	1.0484	1.0501	1.0511	1.0521	1.0565
164	1.0490	1.0508	1.0515	1.0532	1.0542	1.0553	1.0596
161	1.0521	1.0539	1.0546	1.0562	1.0573	1.0583	1.0627
158	1.0552	1.0570	1.0577	1.0593	1.0604	1.0614	1.0658
155	1.0583	1.0601	1.0608	1.0624	1.0635	1.0645	1.0689
152	1.0614	1.0632	1.0638	1.0655	1.0666	1.0676	1.0720
149	1.0645	1.0664	1.0669	1.0686	1.0697	1.0707	1.0751
146	1.0676	1.0695	1.0700	1.0717	1.0728	1.0738	1.0782
143	1.0707	1.0725	1.0731	1.0748	1.0758	1.0769	1.0813
140	1.0738	1.0756	1.0762	1.0779	1.0789	1.0800	1.0844
137	1.0768	1.0787	1.0793	1.0809	1.0820	1.0831	1.0875
134	1.0799	1.0818	1.0824	1.0840	1.0851	1.0861	1.0905
131	1.0830	1.0849	1.0854	1.0871	1.0882	1.0892	1.0936
128	1.0861	1.0879	1.0885	1.0902	1.0913	1.0923	1.0967
125	1.0892	1.0910	1.0916	1.0933	1.0944	1.0954	1.0998
122	1.0923	1.0941	1.0947	1.0964	1.0974	1.0985	1.1029
119	1.0953	1.0972	1.0978	1.0995	1.1005	1.1015	1.1060
116	1.0984	1.1002	1.1009	1.1025	1.1036	1.1046	1.1091
113	1.1015	1.1033	1.1039	1.1056	1.1067	1.1077	1.1121
110	1.1046	1.1064	1.1070	1.1087	1.1098	1.1108	1.1162
107	1.1077	1.1095	1.1101	1.1118	1.1128	1.1139	1.1182
104	1.1108	1.1126	1.1132	1.1149	1.1159	1.1170	1.1214
101	1.1138	1.1156	1.1163	1.1179	1.1190	1.1201	1.1245
98	1.1169	1.1187	1.1193	1.1210	1.1221	1.1231	1.1275
95	1.1200	1.1218	1.1224	1.1241	1.1252	1.1262	1.1306
92	1.1231	1.1249	1.1255	1.1272	1.1282	1.1293	1.1337
89	1.1262	1.1280	1.1286	1.1303	1.1313	1.1324	1.1368
86	1.1292	1.1311	1.1317	1.1333	1.1344	1.1355	1.1399
83	1.1323	1.1342	1.1347	1.1364	1.1375	1.1385	1.1429
80	1.1354	1.1372	1.1378	1.1395	1.1406	1.1416	1.1460
77	1.1385	1.1403	1.1409	1.1426	1.1437	1.1447	1.1491
74	1.1416	1.1434	1.1440	1.1457	1.1468	1.1478	1.1522
71	1.1446	1.1465	1.1471	1.1488	1.1498	1.1509	1.1553
68	1.1477	1.1496	1.1502	1.1518	1.1529	1.1540	1.1584
65	1.1508	1.1527	1.1532	1.1549	1.1560	1.1571	1.1615
62	1.1539	1.1557	1.1563	1.1580	1.1591	1.1601	1.1645
59	1.1570	1.1588	1.1594	1.1611	1.1622	1.1632	1.1676
56	1.1601	1.1619	1.1625	1.1642	1.1653	1.1663	1.1707
53	1.1631	1.1650	1.1656	1.1673	1.1684	1.1694	1.1738
50	1.1662	1.1681	1.1687	1.1704	1.1715	1.1725	1.1769
47	1.1693	1.1712	1.1718	1.1735	1.1746	1.1756	1.1800
44	1.1724	1.1743	1.1749	1.1766	1.1777	1.1787	1.1831
41	1.1755	1.1774	1.1780	1.1797	1.1808	1.1818	1.1862
38	1.1786	1.1815	1.1821	1.1828	1.1839	1.1849	1.1891
35	1.1818	1.1836	1.1842	1.1859	1.1870	1.1880	1.1924
32	1.1849	1.1867	1.1873	1.1890	1.1901	1.1911	1.1955

Number of Gallons in Round Tanks

Diameter, Inches

Depth or Length	18-inch	24-inch	30-inch	36-inch	42-inch	48-inch	54-inch	60-inch	66-inch	72-inch
1 Inch	1.10	1.96	3.06	4.41	5.99	7.83	9.91	12.24	14.81	17.62
1 ft.	13.	23.	37.	53.	72.	94.	119.	147.	178.	211.
1½ ft.	20.	35.	55.	79.	108.	141.	179.	220.	267.	317.
2 ft.	26.	47.	73.	106.	144.	188.	238.	294.	355.	423.
2½ ft.	33.	59.	92.	132.	180.	235.	298.	367.	444.	529.
3 ft.	40.	71.	110.	159.	216.	282.	357.	441.	533.	634.
3½ ft.	46.	82.	129.	185.	252.	329.	417.	514.	622.	740.
4 ft.	53.	94.	147.	211.	288.	376.	476.	587.	711.	846.
4½ ft.	59.	106.	165.	238.	324.	423.	536.	661.	800.	952.
5 ft.	66.	118.	183.	264.	360.	470.	597.	734.	889.	1157.
5½ ft.	73.	129.	202.	291.	396.	517.	657.	808.	977.	1263.
6 ft.	79.	141.	220.	317.	432.	564.	714.	881.	1066.	1369.
7 ft.	92.	164.	257.	370.	504.	658.	833.	1028.	1244.	1580.
8 ft.	106.	188.	294.	423.	576.	752.	952.	1175.	1422.	1792.
9 ft.	119.	212.	330.	476.	648.	846.	1071.	1322.	1599.	2003.
10 ft.	132.	235.	367.	529.	720.	940.	1190.	1469.	1777.	2115.
12 ft.	157.	282.	440.	634.	864.	1128.	1428.	1762.	2133.	2537.
14 ft.	185.	329.	514.	740.	1008.	1316.	1666.	2056.	2488.	2960.
16 ft.	211.	376.	587.	846.	1152.	1504.	1904.	2350.	2844.	3383.
18 ft.	238.	423.	661.	952.	1296.	1692.	2142.	2644.	3199.	3806.
20 ft.	264.	470.	734.	1057.	1440.	1880.	2380.	2937.	3554.	4229.

One-inch depth is given to facilitate figuring intermediate depths.

For tanks having a diameter other than those given in the table, multiply the square of the diameteter in inches by the length in feet and multiply this product by 0.0408 to obtain tank capacity in U. S. gallons. When both diameter and length are given in inches, the capacity in U. S. gallons equals $0.0034 \times d^2 L$.

Pressure for Different Heads of Water at 62 Degrees Fah.

1 Foot head = 0.43302 lb. per sq. in. 1 inch head = 0.5774 ounces per sq. in.

Inches of Water to Ounces per Square Inch

Head, inches	1	2	3	4	5	6	7	8	9	10	11	12
Pressure, inches	.577	1.15	1.73	2.31	2.89	3.46	4.04	4.62	5.20	5.77	6.35	6.93

Feet of Water to Pounds per Square Inch

Head, feet	0	1	2	3	4	5	6	7	8	9
0	.....	0.433	0.866	1.299	1.732	2.165	2.598	3.031	3.464	3.897
10	4.330	4.763	5.196	5.629	6.062	6.495	6.928	7.361	7.794	8.227
20	8.660	9.093	9.526	9.959	10.392	10.825	11.258	11.691	12.124	12.557
30	12.990	13.423	13.856	14.289	14.722	15.155	15.588	16.021	16.454	16.887
40	17.320	17.753	18.186	18.619	19.052	19.485	19.918	20.351	20.784	21.217
50	21.650	22.083	22.516	22.949	23.382	23.815	24.248	24.681	25.114	25.547
60	25.980	26.413	26.846	27.279	27.712	28.145	28.578	29.011	29.444	29.877
70	30.310	30.743	31.176	31.609	32.042	32.475	32.908	33.341	33.774	34.207
80	34.640	35.073	35.506	35.939	36.372	36.805	37.238	37.671	38.104	38.537
90	38.970	39.403	39.836	40.269	40.702	41.135	41.568	42.001	42.436	42.867

Example: For head of 18 ft., pressure is 7.794 lbs. per sq. in.

90	38.970	39.403	39.836							

Example: For head of 18 ft., pressure is 7.794 lbs. per sq. in.

Head of Water at 62° Fah. Corresponding to Different Pressures

1 pound per sq. in. = 2.3095 feet head. 1 ounce per sq. in. = 1.732 in. of water.

Ounces per Square Inch to Inches of Water

Pressure, ounces	1	2	3	4	5	6	7	8
Head, inches	1.73	3.46	5.20	6.93	8.66	10.39	12.12	13.85
Pressure, ounces	9	10	11	12	13	14	15	16
Head, inches	15.59	17.32	19.05	20.78	22.52	24.25	25.98	27.71

Pounds per Square Inch to Feet of Water

Pressure	0	1	2	3	4	5	6	7	8	9
0		2.31	4.62	6.93	9.24	11.55	13.86	16.17	18.48	20.78
10	23.09	25.40	27.71	30.02	32.33	34.64	36.95	39.26	41.57	43.88
20	46.19	48.50	50.81	53.12	55.43	57.74	60.05	62.36	64.66	66.97
30	69.28	71.59	73.90	76.21	78.52	80.83	83.14	85.45	87.76	90.07
40	92.38	94.69	97.00	99.31	101.62	103.93	106.24	108.55	110.85	113.16
50	115.47	117.78	120.09	122.40	124.71	127.02	129.33	131.64	133.95	136.26
60	138.57	140.88	143.19	145.50	147.81	150.12	152.42	154.73	157.04	159.35
70	161.66	163.97	166.28	168.59	170.90	173.21	175.52	177.83	180.14	182.45
80	184.76	187.07	189.38	191.69	194.00	196.31	198.61	200.92	203.23	205.54
90	207.85	210.16	212.47	214.78	217.09	219.40	221.71	224.02	226.33	228.64

Example: For pressure of 27 lbs. per sq. in., head is 62.36 feet.

Metric and English Measures

Measures of Length

Metric			English
1	metre	=	39.37 inches
			3.28 feet
.3048	metre	=	1 foot
1	centimetre	=	.3937 inch
2.54	centimetres	=	1 inch
1	millimetre	=	.03937 in .(1/25 in., nearly)
25.4	millimetres	=	1 inch
1	kilometre	=	093.61 yards

Measures of Surface

1	square metre	=	10.764 square feet
.0929	square metre	=	1 square foot
1	square centimetre	=	.155 square inch
6.452	square centimetres	=	1 square inch
1	square millimetre	=	.00155 square inch
645.2	square millimetres	=	1 square inch

Measures of Volume

1	cubic metre	=	35.314 cubic feet
.02832	cubic metre	=	1 cubic foot
1	cubic decimetre	=	61.023 cubic inches
			.0353 cubic foot
28.32	cubic decimetres	=	1 cubic foot
16.387	cubic centimetres	=	1 cubic inch
1	cubic centimetre	=	1 millimetre
			.061 cubic inch

Measures of Capacity

			61.023 cubic inches
			.0353 cubic foot
1	litre = 1 cubic decimetre	=	.2202 gallon (Imperial)
			2.202 pounds of water at 62 degrees Fahr.
28.317	litres	=	1 cubic foot (6.25 imperial gallons)
4.543	litres	=	1 gallon (Imperial)
3.785	litres	=	1 gallon (American)

Measures of Weight

28.35	grammes	=	1 ounce avoirdupois
1	kilogramme	=	2.2046 pounds
.4536	kilogramme	=	1 pound
1	metric ton	=	.9842 ton of 2240 lbs., or
1000	kilogrammes		19.68 cwts. of 2204.6 lbs.
1.016	metric ton	=	1 ton of 2240 pounds
1016	kilogrammes		

Miscellaneous

1	gramme per square millimetre	=	1.422 lbs. per square inch
1	kilogramme per square millimetre	=	1422.32 lbs. per square inch
1	kilogramme per square centimetre	=	14.223 lbs. per square inch
1.0335	kg. per sq. centimetre 1 atmosphere	=	14.7 lbs. per square inch
0.070308	kilogramme per square centimetre	=	1 lb. per square inch

Metric and English Measures—Continued

Measures of Pressure and Weight

lb. per square inch..... =	144	lbs. per square foot
	2.0355	inches of mercury at 32 degrees Fahr.
	2.0416	inches of mercury at 62 degrees Fahr.
	2.309	ft. of water at 62 degrees Fahr.
	27.71	inches of water at 62 degrees Fahr.
Atmospheric (14.7 lbs. per sq. in.)..... =	2116.3	lbs. per square foot
	33.947	ft. of water at 62 degrees Fahr.
	30	inches of mercury at 62 degrees Fahr.
	29.922	inches of mercury at 32 degrees Fahr.
	760	millimetres of mercury at 32 degrees Fahr.
Foot of Water at 62 degrees Fahr..... =	.433	lbs. per square inch
	62.355	lbs. per square foot
Inch of Mercury at 62 degrees Fahr..... =	.491	lb. or 7.86 oz. per sq. in.
	1.132	ft. of water at 62 degrees Fahr.
	13.58	inches of water at 62 degrees Fahr.

Measure of Solidity, Liquid Measure

1728 cubic inches =	1 cubic foot	4	gills	make 1 pint
27 cubic feet =	1 cubic yard	2	pints	make 1 quart
		4	quarts	make 1 gallon
		31½	gallons	make 1 barrel

Circular Measure

60 Seconds ″ = 1 Minute ′
60 Minutes ′ = 1 Degree °
90 Degrees ° = 1 Quadrant
360 Degrees ° = 1 Circumference

Measure of Surface

144 Sq. in. } = 1 Sq. Ft.
183.35 Cir. In. }
9 Sq. Ft. = 1 Sq. Yd.
30¼ Sq. Yds. } = 1 Sq. Rd.
272¼ Sq. Ft. }

Square Inches x .007 = Square Feet
Cubic Inches x .00058 = Cubic Feet

Weights

1 cubic inch of Cast Iron	weighs	0.260 pounds
1 cubic inch of Wrought Iron	weighs	0.280 pounds
1 cubic inch of Water	weighs	0.036 pounds
1 U. S. Gallon	weighs	8.330 pounds
1 Imperial Gallon	weighs	10.000 pounds
1 U. S. Gallon	equals	231.000 cubic inches
1 Imperial Gallon	equals	277.274 cubic inches
1 cubic foot of water	equals	7.840 U. S. Gal.
1 pound of Steam	equals	27.222 cubic feet
1 pound of Air	equals	13.817 cubic feet

Boiling Points of Various Fluids

	Degrees		Degrees
Water, Atmospheric Pressure	212	Refined Petroleum	316
Alcohol	173	Turpentine	315
Sulphuric Acid	240	Sulphur	570
		Linseed Oil	597

Melting Points of Different Metals

	Degrees		Degrees
Aluminum	1400	Iron (cast)	2450
Antimony	810	Iron (wrought)	2912
Bismuth	476	Lead	608
Brass	1900	Platinum	3080
Bronze	1692	Silver (pure)	1870
Copper	1996	Steel	2503
Glass	2377	Tin	446
Gold (pure)	2590	Zinc	680

NOTE—Above information is quoted from standard authorities. Not guaranteed.

Weight of One Cubic Foot of Pure Water

At 32 degrees Fahr. (freezing point)	62.418	lbs.
At 39.1 degrees Fahr. (maximum density)	62.425	lbs.
At 62 degrees Fahr. (standard temperature)	62.355	lbs
At 212 degrees Fahr. (boiling point, under 1 atmosphere)	59.76	lbs.
Imperial gallon = 277.274 cubic inches of water at 62 degrees Fahr. =	10	lbs.
American gallon = 231 cubic inches of water at 62 degrees Fahr. . =	8.3356	lbs.

General Data

1 Calorie	=	3.968	B. T. U.
1 B. T. U.	=	0.252	Calorie
1 lb. per sq. in.	=	703.08	kilogrammes per m²
1 Kilogramme per m²	=	.00142	lbs. per sq. in.
1 Calorie m²	=	.3687	B. T. U. per sq. ft.
B. T. U. per sq. ft.	=	2.712	calorie per m²
1 Calorie per m² per degree difference Cent.	=	.2048	B. T. U. per sq. ft. per degree difference Fahr.
1 B. T. U. per sq. ft. per degree difference Fahr.	=	4.882	Calories per m² per degree difference Cent.
1 B. T. U. per lb.	=	.556	Calories per kilog.
1 Calorie per kilog.	=	1.8	B. T. U. per lb.
1 Litre of Coke at 26.3 lbs. per cubic foot. .	=	.93 lbs.	
1 lb. of Coke at 26.3 per cubic foot	=	1.076	litres
Water expands in bulk from 40 degrees to 212 degrees	=	One twenty-third.	

A cubic inch of water evaporated under ordinary atmospheric pressure is converted into 1 cubic foot of steam (approximately).

Table of Decimal Equivalents of Fractions of One Inch

1/64	.0156	17/64	.2656	33/64	.5156	49/64	.7656
1/32	.0312	9/32	.2812	17/32	.5312	25/32	.7812
3/64	.0468	19/64	.2968	35/64	.5468	51/64	.7968
1/16	.0625	5/16	.3125	9/16	.5625	13/16	.8125
5/64	.0781	21/64	.3281	37/64	.5781	53/64	.8281
3/32	.0937	11/32	.3437	19/32	.5937	27/32	.8437
7/64	.1093	23/64	.3593	39/64	.6093	55/64	.8593
1/8	.125	3/8	.375	5/8	.625	7/8	.875
9/64	.1406	25/64	.3906	41/64	.6406	57/64	.8906
5/32	.1562	13/32	.4062	21/32	.6562	29/32	.9062
11/64	.1718	27/64	.4218	43/64	.6718	59/64	.9219
3/16	.1875	7/16	.4375	11/16	.6875	15/16	.9375
13/64	.2031	29/64	.4531	45/64	.7031	61/64	.9531
7/32	.2187	15/32	.4687	23/32	.7187	31/32	.9687
15/64	.2343	31/64	.4843	47/64	.7343	63/64	.9843
1/4	.25	1/2	.5	3/4	.75	1	1.0

nowing the Loss in Conductivity of Boiler Plate Due to Difference in Thickness of Soot Deposit

Thickness of Soot	Loss Per Cent.
Clean	0.0
1/32"	9.5
1/16"	26.2
1/8"	45.2
1/16"	69.0

Proceedings, Institute of Marine Engineers, January 6, 1908.

able of the Weights of Galvanized Iron Pipe in Pounds per Running Foot

Diam. of Pipe Inches	GAUGE OF IRON					Diam. of Pipe Inches	GAUGE OF IRON				
	No. 24	No. 22	No. 20	No. 18	No. 16		No. 24	No. 22	No. 20	No. 18	No. 16
5	1 3/4	2	2 1/2	3 1/8	4	28	9 1/2	11 3/8	14	18	21 1/2
6	2 1/8	2 1/2	3	4	4 3/4	30	10	12 1/4	15	19 1/8	23
7	2 1/2	3	3 1/2	4 5/8	5 1/2	32	.....	13 1/8	16	20 3/4	24 5/8
8	2 7/8	3 3/8	4	5 1/4	6 3/4	34	.....	14	17	22	26 1/4
9	3 1/4	3 3/4	4 1/2	5 7/8	7	36	.....	15	18	23 3/4	27 7/8
10	3 1/2	4	5	6 1/2	7 5/8	38	.....	16	19	24 1/2	29 1/2
11	3 3/4	4 1/4	5 1/2	7	8 1/4	40	.....	17	20	26 1/4	31 1/4
12	4	4 5/8	6	7 1/2	9	42	.....	.....	21	28	33
13	4 1/4	5 1/8	6 1/2	8 3/8	10	44	.....	.....	22	29 3/4	35
14	4 5/8	5 1/2	7	8	11	46	.....	.....	23	31 1/2	37
15	5	6	7 1/2	9 5/8	12	48	.....	.....	24	33 1/4	39
16	5 1/2	6 1/2	8	10 1/4	13	50	.....	.....	25	35	41
18	6	7 1/4	9	11 1/2	14 1/4	52	.....	.....	26	36 3/4	43
20	6 1/2	8	10	12 3/4	15 1/2	54	.....	.....	27	38 1/2	45
22	7 1/4	8 3/4	11	14	16 3/4	56	.....	.....	28	40 1/4	47
24	8	9 5/8	12	15 1/4	18 1/2	58	.....	.....	29	42	49
26	8 3/4	10 1/2	13	16 1/2	20	60	.....	.....	30	43 3/4	51

In above table allowance has been made for laps, trimmings, rivets and solder.

Specific Gravities and Weights of Various Substances

The Basis for Specific Gravities is Pure Water at 62 Degrees Fahr., Barometer 30 Inches Weight of One Cubic Foot, 62.355 Pounds	Average Specific Gravity Water = 1	Average Weight of One Cu. Ft. Pounds
Air, atmospheric at 60 degrees F., under pressure of one atmosphere, or 14.7 pounds per square inch, weighs 1/815 as much as water	.00123	.0765
Aluminum	2.6	162
Anthracite, 1.3 to 1.84; of Penna., 1.3 to 1.7	1.5	93.5
Anthracite, broken, of any size, loose		52 to 57
Anthracite, broken, moderately shaken		56 to 60
Anthracite, broken, heaped bushel, loose, 77 to 83 lbs		
Anthracite, broken, a ton loose occupies 40 to 43 cu. ft.		
Ash, American White, dry	.61	38
Ashes of soft coal, solidly packed		40 to 45
Brass (copper and zinc), cast, 7.8 to 8.4	8.1	504
Brass, rolled	8.4	524
Brick, best pressed		150
Brick, common and hard		125
Brick, soft inferior		100
Cement, hydraulic, American, Rosendale, ground and loose		56
Cement, hydraulic, American, Rosendale, U. S. struck bush., 70 pounds		
Cement, hydraulic, American, Cumberland, ground, loose		65
Cement, hydraulic, American, Cumberland, ground, thoroughly shaken		85
Cement, hydraulic. English, Portland, a barrel, 400 to 430 pounds		
Cement, hydraulic, American Portland, loose		88
Cement, hydraulic, American Portland, thoroughly shaken		110
Charcoal of pines and oaks		15 to 30
Coal, bituminous, solid, 1.2 to 1.5	1.35	84
Coal, bituminous, solid, Cambria Co., Pa., 1.27-1.34		79 to 84
Coal, bituminous, broken, of any size, loose		47 to 52
Coal, bituminous, 1 ton occupies 43 to 48 cu. ft.		
Coke, loose, good quality		23 to 32
Coke, loose, a heaped bushel, 35 to 42		
Coke, 1 ton occupies 80 to 97 cubic feet		
Earth, common loam, perfectly dry, loose		72 to 80
Earth, common loam, perfectly dry, shaken		82 to 92
Earth, common loam, perfectly dry, rammed		90 to 100
Glass, 2.5 to 3.45	2.98	186
Glass, common window	2.52	157
Granite, 2.56 to 2.88	2.72	170
Ice, .917 to .922	.92	57.4
Iron, cast, 6.9 to 7.4	7.15	446
Iron, grey foundry, cold	7.21	450
Iron, grey foundry, molten	6.94	433
Iron, wrought	7.69	480
Lead, commercial	11.38	709.6
Limestone and marble	2.6	164.4
Lime, quick	1.5	95
Lime, quick, ground, well shaken, per struck bushel 80 pounds		64
Masonry of granite or limestone, well-dressed		165
Mercury, at 32 degrees Fahr.	13.62	849
Petroleum	.878	54.8
Pitch	1.15	71.7
Sand, of pure quartz, perfectly dry and loose		90 to 10
Sand, of pure quartz, voids full of water		118 to 12

Specific Gravities and Weights of Various Substances—Continued

The Basis for Specific Gravities is Pure Water at 62 Degrees Fahr., Barometer 30 Inches Weight of One Cubic Foot, 62.355 Pounds	Average Specific Gravity Water = 1.	Average Weight of One Cu. Ft. Pounds
Sand, of pure quartz, very large and small grains, dry	.....	117
Sandstone, 2.1 to 2.73, 131 to 171	2.41	151
Sandstone, quarried and piled, 1 measure solid makes 1¾ (about) piled	.....	86
Snow, fresh fallen	.....	5 to 12
Snow, moistened, compacted by rain	.....	15 to 50
Slate, 2.7 to 2.9	2.8	175
Steel	7.85	489.6
Tar	1	62.355
Water, pure rain, distilled, at 32 degrees Fahr., Bar. 30 inches	.....	62.417
Water, pure rain, distilled, at 62 degrees Fahr., Bar. 30 inches	1	62.355
Water, pure rain, distilled, at 212 degrees Fahr., Bar. 30 inches	.....	59.7
Water, sea, 1.026 to 1.030	1.028	64.08

Specific Heat of Various Substances

Water	1.0000	Birch	0.4800
Air	0.2375	Oak	0.5700
Oxygen	0.2175	Plaster	0.2000
Nitrogen	0.2438	Glass	0.1937
Hydrogen	3.4090	Brickwork	0.1950
Coal	0.2777	Masonry	0.2159
Coke	0.2010	Cast Iron	0.1298
Petroleum	0.4340	Wrought iron	0.1138
Pine	0.4670	Steel (soft)	0.1165

Circumference of Circles

Diameter	Circumference	Diameter	Circumference	Diameter	Circumference	Diameter	Circumference
1/8	.3927	10	31.41	30	94.24	65	204.2
1/4	.7854	10 1/2	32.98	31	97.38	66	207.3
3/8	1.178	11	34.55	32	100.5	67	210.4
1/2	1.570	11 1/2	36.12	33	103.6	68	213.6
5/8	1.963	12	37.69	34	106.8	69	216.7
3/4	2.356	12 1/2	39.27	35	109.9	70	219.9
7/8	2.748	13	40.84	36	113.0	71	223.0
1	3.141	13 1/2	42.41	37	116.2	72	226.1
1 1/8	3.534	14	43.98	38	119.3	73	229.3
1 1/4	3.927	14 1/2	45.55	39	122.5	74	232.4
1 3/8	4.319	15	47.12	40	125.6	75	235.6
1 1/2	4.712	15 1/2	48.69	41	128.8	76	238.7
1 5/8	5.105	16	50.26	42	131.9	77	241.9
1 3/4	5.497	16 1/2	51.83	43	135.0	78	245.0
1 7/8	5.890	17	53.40	44	138.2	79	248.1
2	6.283	17 1/2	54.97	45	141.3	80	251.3
2 1/4	7.068	18	56.54	46	144.5	81	254.4
2 1/2	7.854	18 1/2	58.11	47	147.6	82	257.6
2 3/4	8.639	19	59.69	48	150.7	83	260.7
3	9.424	19 1/2	61.26	49	153.9	84	263.8
3 1/4	10.21	20	62.83	50	157.0	85	267.0
3 1/2	10.99	20 1/2	64.40	51	160.2	86	270.1
3 3/4	11.78	21	65.97	52	163.3	87	273.3
4	12.56	21 1/2	67.54	53	166.5	88	276.4
4 1/2	14.13	22	69.11	54	169.6	89	279.6
5	15.70	22 1/2	70.68	55	172.7	90	282.7
5 1/2	17.27	23	72.25	56	175.9	91	285.8
6	18.84	23 1/2	73.82	57	179.0	92	289.0
6 1/2	20.42	24	75.39	58	182.2	93	292.1
7	21.99	24 1/2	76.96	59	185.3	94	295.3
7 1/2	23.56	25	78.54	60	188.4	95	298.4
8	25.13	26	81.68	61	191.6	96	301.5
8 1/2	26.70	27	84.82	62	194.7	97	304.7
9	28.27	28	87.96	63	197.9	98	307.8
9 1/2	29.84	29	91.10	64	201.0	99	311.0

To compute the circumference of a diameter greater than any in the above table:

RULE.—Divide the dimension by 2, 3, 4, etc., if practicable, until it is reduced to a dimension to be found in the table. Take the tabular circumference of this diameter, multiply it by 2, 3, 4, etc., according as it was divided, and the product will be the circumference required.

EXAMPLE.—What is the circumference of a diameter of 125? $125 \div 5 = 25$. Tabular circumference of $25 = 78.54$; $78.54 \times 5 = 392.7$, circumference required.

To find the diameter of a circle when circumference is given, multiply the given circumference by .31831.

To find circumference of a circle when diameter is given, multiply the given diameter by 3.1416.

Area of Circles

Diam-eter	Area	Diam-eter	Area	Diam-eter	Area	Diam-eter	Area
1/8	0.0123	10	78.54	30	706.86	65	3318.3
1/4	0.0491	10½	86.59	31	754.76	66	3421.2
3/8	0.1104	11	95.03	32	804.24	67	3535.6
1/2	0.1963	11½	103.86	33	855.30	68	3631.6
5/8	0.3068	12	113.09	34	907.92	69	3739.2
3/4	0.4418	12½	122.71	35	962.11	70	3848.4
7/8	0.6013	13	132.73	36	1017.8	71	3959.2
	0.7854	13½	143.13	37	1075.2	72	4071.5
1/8	0.9940	14	153.93	38	1134.1	73	4185.4
1/4	1.227	14½	165.13	39	1194.5	74	4300.8
3/8	1.484	15	176.71	40	1256.6	75	4417.8
1/2	1.767	15½	188.69	41	1320.2	76	4536.4
5/8	2.073	16	201.06	42	1385.4	77	4656.6
3/4	2.405	16½	213.82	43	1452.2	78	4778.3
7/8	2.761	17	226.98	44	1520.5	79	4901.6
	3.141	17½	240.52	45	1590.4	80	5026.5
1/4	3.976	18	254.46	46	1661.9	81	5153.0
1/2	4.908	18½	268.80	47	1734.9	82	5281.0
3/4	5.939	19	283.52	48	1809.5	83	5410.6
	7.068	19½	298.64	49	1885.7	84	5541.7
1/4	8.295	20	314.16	50	1963.5	85	5674.5
1/2	9.621	20½	330.06	51	2042.8	86	5808.8
3/4	11.044	21	346.36	52	2123.7	87	5944.6
	12.566	21½	363.05	53	2206.1	88	6082.1
1/2	15.904	22	380.13	54	2290.2	89	6221.1
	19.635	22½	397.60	55	2375.8	90	6361.7
1/2	23.758	23	415.47	56	2463.0	91	6503.9
	28.274	23½	433.73	57	2551.7	92	6647.6
1/2	33.183	24	452.39	58	2642.0	93	6792.9
	38.484	24½	471.43	59	2733.9	94	6939.8
1/2	44.178	25	490.87	60	2827.4	95	7088.2
	50.265	26	530.93	61	2922.4	96	7238.2
1/2	56.745	27	572.55	62	3019.0	97	7389.8
	63.617	28	615.75	63	3117.2	98	7542.9
1/2	70.882	29	660.52	64	3216.9	99	7697.7

To compute the area of a diameter greater than any in the above table:

RULE.—Divide the dimension by 2, 3, 4, etc., if practicable, until it is reduced a quotient to be found in the table, then multiply the tabular area of the quotient the square of the factor. The product will be the area required.

EXAMPLE.—What is area of diameter of 150? 150 ÷ 5 = 30. Tabular area 30 = 706.88 which × 25 = 17,671.5, area required.

To obtain area of circle, square diameter and multiply by .7854 or square the dius and multiply by 3.1416.

Telegraph Code

Special Notice

PLEASE bear in mind the following in using the telegraph code:

1. Telegraph only when the matter is urgent. When a letter will answer the purpose, it is *surer*, as errors in transmission cannot then occur.

2. Where a blank occurs in a sentence, the word or words supplying the blank must *always follow* the code word of the sentence.

3. Except in cablegrams, ten words are as cheap as any number less. Avoid code where the matter can be covered in ten words without it.

4. When ordering, always specify *hard coal* or *soft coal* boilers, for *steam* or *water*, as the case may be.

5. Write plainly and begin each code word with a capital letter.

Quotations and Correspondence

At what price and how soon can you furnish	Dab
Quote best price on	Dabbling
Quote best price on following radiation	Dado
Wire reply quick	Daft
Wire customer direct	Dante
Wire branch direct	Daub
Specifications to follow within	Dawning
Will wire you to-morrow morning	Dagger
Will write you to-morrow morning	Dainty
Have written	Dairymaid
Answer by first mail	Daisy
Full particulars in letter of	Dale
Have received no reply from you to our letter of	Dally
Referring to your telegram of ——	Damask
Referring to your letter of ——	Dame
Referring to our telegram of ——	Dampness
Referring to our letter of ——	Damsel
Referring to telephone communication to-day	Dance
Do not understand the meaning of ——	Dandy
We quote you for immediate acceptance	Danish
F. O. B. Factory	Deacon

Quotations and Correspondence—Continued

Delivered at	Deadhead
F. O. B. Factory, published freight allowance	Danger
Terms, 30 days, 2 per cent 10 days	Decapitate
Terms, 60 days, 2 per cent 10 days	Darn
Terms, net cash	Dared
Terms, draft and B/L	Decay
What is carload freight rate to?	Decigram
What is less than carload freight rate to?	Dapper
Best carload freight quoted is	Dare
Best less-than-carload freight rate quoted is	Darkness
Will wire you freight rate as soon as received	Darken
Please reply at once to our telegram	Darling

Orders and Shipments

Ship immediately by freight	Earl
Ship immediately by freight prepaid	Earmark
Ship immediately by express	Eater
Ship immediately by express prepaid	Easterly
Ship immediately by parcel post	Ensign
Ship by first boat	Empire
Ship by best route	Earning
Ship immediately and follow with tracer	Earthquake
Can you ship immediately?	Emperor
Can ship immediately	Elder
Can ship immediately if tapping is regular, otherwise a day or two may be necessary, but can make prompt shipment	Emerge
Can't ship time stated in your order, but can ship promptly	Emption
Ship by same route as our order No.	Eclipse
Ship what you can at once, balance soon as possible	Edict
Do not hold for other orders, but rush without delay	Edify
When will you ship order (No. or date)?	Educate
When and by what route did you ship our order?	Effigy
When can you make shipment?	Editor
Will ship in about	Elect
Your order No. —— was shipped	Element
Order No. —— is ready for shipment	Eligible
Your order —— is ready for shipment, except ——. Shall we make shipment?	Encompass
Hold for instructions. Order (No.)	Elbowing
Send shipping tickets to	Elk

Orders and Shipments—Continued

Add to our order (No.) ..... Egg
Omit —— from our order (No.) ..... Elate
Substitute on our order (No.) ..... Elastic
Duplicate our order (No.) ..... Electo
Wire trace our order (No.) ..... Effuse
Give date or number of order referred to ..... Elephant
Ship as small lot unless car going at once ..... Edition
We have no car going for —— days ..... Elevator
Shall we forward as small lot? ..... Elfin
Will send shipping instructions by mail ..... Edentate
Shipping instructions for order (No.) ..... Edge
Enter order at your quotation of ..... Echo
Enter order as per our inquiry of ..... Ebonized
Send us bill of lading covering our order (No.) ..... Eaves
Will mail you to-day bill of lading covering order (No.) ..... Energetic
Ship with draft attached to bill of lading ..... Easel
Will ship your order ..... Enfeebled
When will car be shipped containing our order? ..... Engender
Wire routing on shipment of our order ..... Enkindle
Routing on your shipment is as follows ..... Enlighten
Wire instructions ..... Elixir
Order (No.) has not been shipped ..... Elope
Your order does not specify steam or water. Wire which is wanted ..... Elusion
Change our order (No.) to read ..... Embalm
Referring to your order ..... Embankment
Referring to our order ..... Embargo
Do not find any order from you ..... Emblem
We cannot promise definitely, but will give best attention ..... Emboss
Include in car for —— which left ..... Embrace
Include in first car to —— ..... Embrasure
We cannot furnish ..... Emetic
Must have —— at once. Can't wait for ..... Emigrant
Latter part of this week ..... Enriching
First of next week ..... Enslave
Latter part of next week ..... Entertainer

Table of Time

1 day	Swelling	12 days	Syenite
2 days	Swelter	1 week	Syllabic
3 days	Swerving	2 weeks	Sylphlike
4 days	Swiftness	3 weeks	Symbolic
5 days	Swimming	1 month	Sagacious
6 days	Swingle	2 months	Symmetral
10 days	Swooning	3 months	Sympathetic

Numerals

To be used when giving quantities, order numbers, weights, dollars and cents, etc.

1.....ON	6.....SI	Repeat.....X	
2.....TO	7.....VE	Dollars.....DO	
3.....TH	8.....EI	Feet.....FE	
4.....FO	9.....NI	Discount.....Dis	
5.....IV	0.....OH		

Examples

10155. 1–on 0–oh 1–on 5-iv 5-x (used instead of repeating iv)—onohonivx.

$146.80. 1–on 4–fo 6–si dollars-do 8–ei 0–oh—onfosidoeioh.

1,100 feet. 1–on 1–x 0–oh 0–x feet–fe—onxohxfe.

14,000. 1–on 4–fo 0–oh 0–x 0–oh (oh is repeated to avoid having two x's)—onfoohxoh.

In writing telegram use all small letters and join together to make one complete word. To avoid confusion on long numbers it is sometimes advisable to print the characters. In that case, use all capitals, viz.: 1468–ONFOSIEI.

An easy method of deciphering can be used by separating every two letters, starting at the left, except where X appears.

ivohxdotosi—iv oh x do to si—500 dollars 26 $500.26

Height of Radiator

	Inches High		Inches High
Nabbing	12½	Nappal	20½
Nadir	13	Narcissus	22
Naiad	14	Narcotic	23
Naggy	14½	Narrate	26
Nailer	16½	Narrify	32
Namesake	17	Narwhal	38
Napery	18	Nasal	44
Naptha	20	Nasturtium	45

Number of Sections

	Sections		Sections
Oatmeal	2	Objective	8
Obdurate	3	Oblation	9
Obeisant	4	Oblique	10
Obelisk	5	Oblivion	11
Obesity	6	Oblong	12
Obfuscate	7	Oboe	13

Florentine Radiation—Continued

New Style

Refract	44–4	Romish
Regent	38–4	Rosiny
Reindeer	32–4	Rubric
Regress	26–4	Ruffian
Relucent	22–4	Rumple
Renitent	18–4	Rupee

Triton Wall Radiators

Triton Wall, steam, 5 feet	Flank
Triton Wall, water, 5 feet	Flare
Triton Wall, steam, 7 feet	Flush
Triton Wall, water, 7 feet	Flask
Triton Wall, steam, 9 feet	Flaunt
Triton Wall, water, 9 feet	Flavor

When ordering Wall Radiation be guided by the following example: Customer wants by express two 6 section 9′ Triton Wall Steam Radiators. Figure 2 tapped 1½ x ½″ top and bottom opposite ends. The part of the telegram representing this would read as follows:

Eater two Flaunt figure two six section Tame Timbrel . . . . .

Indirect Radiators

Pin Indirect, steam, 10 feet	Export
Pin Indirect, water, 10 feet	Expose
Pin Indirect, steam, 15 feet	Caxton
Pin Indirect, water, 15 feet	Ceiling
Pin Indirect, steam, 20 feet	Club
Pin Indirect, water, 20 feet	Cudgel
Not assembled	Currycomb
Assembled with Push Nipples	Curliness
Assembled with R. and L. Screw Nipples	Cutwater
Arranged for Wall Brackets	Culinary

Pantry Radiator

No. 1	No. 2	No. 3	No. 4	No. 5
Pliable	Pliform	Plighter	Plodding	Plough

Special Radiators

Circular for water	Playmate
Circular for steam	Plaything
Corner for water	Plea
Corner for steam	Pleader
Dining Room for water	Pleasance
Dining Room for steam	Pleasure
With saddles for marble top	Plebeian
With spikes in end section, for marble top	Plenal
Triton Fractional	Plenty

Discontinued Patterns for Repairs Only

Old Style

Triton One-column, plain, steam	Cry
Triton One-column, plain, water	Crayon
Triton Two-column, plain, steam	Cow
Triton Two-column, plain, water	Calf
Triton Three-column, plain, steam	Canvas
Triton Three-column, plain, water	Cart
Triton Four-column, plain, steam	Culpable
Triton Four-column, plain, water	Cultivator
Triton Five-column, plain, steam	Cunning
Triton Five-column, plain, water	Curator
	Hamlet
Florentine One-column, steam	Haughty
Florentine One-column, water	Harrow
Florentine Two-column, steam	Hanson
Florentine Two-column, water	Hammer
Florentine Three-column, steam	Harbor
Florentine Three-column, water	Hinder
Florentine Four-column, steam	Harass
Florentine Four-column, water	
	Cavalier
Triton One-column, ornamental, steam	Cavalry
Triton One-column, ornamental, water	Censure
Triton Two-column, ornamental, steam	Centaur
Triton Two-column, ornamental, water	Caution
Triton Three-column, ornamental, steam	Cause
Triton Three-column, ornamental, water	Cave
Triton Four-column, ornamental, steam	Caverns
Triton Four-column, ornamental, water	Crew
Triton Five-column, ornamental, steam	Creep
Triton Five-column, ornamental, water	Candy
Triton Flue, steam	Clay
Triton Flue, water	
	Ennoble
Sun Two-column, steam	Enode
Sun Two-column, water	Enliven
Sun Three-column, steam	Enmity
Sun Three-column, water	
	Enjoyment
Utility Six-column, steam	Envenom
Utility Six-column, water	
	Englut
Champion Indirect	
	Handy
Puritan One-column, steam	Haggard
Puritan One-column, water	Heather
Puritan Two-column, steam	Hickory
Puritan Two-column, water	Hillock
Puritan Three-column, steam	History
Puritan Three-column, water	Halibut
Puritan Four-column, steam	Halter
Puritan Four-column, water	
	Hanker
Puritan Five-column, steam	Happiness
Puritan Window, Five-column, water	
	Contraband
Athenian Wall, five-foot section, steam	Cancerate
Athenian Wall, five-foot section, water	Clincher
Athenian Wall, seven-foot section, steam	Contour
Athenian Wall, seven-foot section, water	Continuate
Athenian Wall, nine-foot section, steam	Cruciform
Athenian Wall, nine-foot section, water	
	Entity
Grecian One-column, plain, steam	Entwine
Grecian One-column, plain, water	Enervate
Grecian Two-column, plain, steam	Enclouded
Grecian Two-column, plain, water	Endure
Grecian Three-column, plain, steam	Enchase
Grecian Three-column, plain, water	Enamour
Grecian Four-column, plain, steam	Endivement
Grecian Four-column, plain, water	

Radiator Miscellanies

Washed and cleaned for vacuum system.....Probation
Triton Three-column Box Bases.....Probative
Triton Flue Box Bases.....Probity
Puritan and Florentine Box Bases.....Procreate
Triton Wall Boxes.....Procedure
Sun Box Bases.....Procession

Athenian Radiator Brackets

R No. 1		R No. 2	R No. 3
Proclivity		Proctor	Prodigal
S	T	U	V
Prodigious	Professor	Profuse	Profusion

Triton Wall Radiator Brackets

No. A6.....Kedge
No. A8.....Keelson
No. A10.....Keep
No. A12.....Kelp
No. A14.....Kennel
No. A16.....Kermes
No. B5½.....Kettle
No. B7½.....Khedive
No. B9½.....Kidnap
No. C.....Kindle
No. D.....Kinetic
No. E.....Kipper
No. F.....Kismet
No. G.....Knapsack
No. H.....Knead
No. I.....Knight
No. L1.....Knock
No. L2.....Kodak

Radiator Repairs

Supply Steam Leg Section.....Ablative
Supply Steam Leg Section, with supply and return at bottom same end.....Ablution
Return Steam Leg Section, open hub.....Abnegate
Return Steam Leg Section, blank hub.....Aboard
Supply Water Leg Section.....Abolition
Return Water Leg Section.....Abreast
Intermediate Steam Section.....Abroach
Intermediate Water Section.....Abrogate
Middle Steam Leg Section.....Abrupt
Middle Water Leg Section.....Abscess
Slip Nipples for steam radiators.....Abscond
Slip Nipples for water radiators.....Absolver
Bushings, 2 x ¾ inches.....Abstain
Bushings, 2 x 1 inches.....Abstemious
Bushings, 2 x 1¼ inches.....Abstinence
Bushings, 2 x 1½ inches.....Abstruse
Plugs, 2 inches.....Abundance
Plugs, 1½ inches.....Abutment
Screw Nipples for steam radiation.....Acacia
Screw Nipples for water radiation.....Academic
Right and Left Screw Nipples with hexagon centers.....Acceding

Capitol-Winchester Boiler Code

No.	Steam	Complete Set of Grates
3130	Gab	Rabbi
3140	Gabel	Raccoon
3230	Gabion	Racket
3240	Gadder	Raddle
3330	Gadfly	Radiate
3340	Gaily	Radish
3350	Gain	Raglan
3440	Gait	Raiment
3450	Gale	Rampant
3460	Gallic	Ransack
3540	Gallop	Rebel
3550	Gambol	Recluse
3560	Game	Recoup
3640	Gape	Redowa
3650	Garb	Refuge
3660	Garlic	Regatta

No.	Water	Complete Set of Grates
4130	Madcap	Fakir
4140	Magic	Falcon
4230	Magnate	Fantasia
4240	Majestic	Faro
4330	Malady	Farmer
4340	Mandolin	Fathom
4350	Marine	Figaro
4440	Marquis	Flagon
4450	Mateless	Fluke
4460	Matin	Folio
4540	Matron	Fontein
4550	Mattress	Frappe
4560	Mayas	Fresco
4640	Maypole	Friction
4650	Mediator	Frontier
4660	Military	Fusion

Capitol Square Boilers

No.	Steam	Water	Complete Set of Grates
184	Exact	Phalanx	Vacancy
185	Exalt	Phantasm	Vacation
186	Examine	Phantom	Vacuity
187	Example	Pharisee	Vagabond
204	Exasperate	Pharos	Vague
205	Excel	Phonotype	Vanilla
206	Excellent	Pianist	Variety
207	Excite	Piazza	Vault
255	Excerpt	Phenix	Valet
256	Excess	Phenol	Valid
257	Exchange	Phial	Valor
258	Exchequer	Philippic	Value
G276	Excise	Philistine	Valve
G277	Exclaim	Philology	Vamp
G278	Exclave	Philosophy	Vandal
G279	Exclude	Philter	Vane
235	Excoriate	Phlegm	Vanity
236	Exculpate	Phonetic	Vantage
237	Excurrent	Phonograph	Vapid
238	Excuse	Phosphate	Vapor
239	Execute	Phosphoric	Variance
240	Executor	Photogen	Varied
WN276	Exegesis	Photosphere	Varlet
WN277	Exemplar	Phrase	Various
WN278	Exempt	Phrenic	Varnish
WN279	Exercise	Phthisis	Vascular
WN280	Exergue	Phycology	Vase
WN281	Exert	Physic	Vassal
WN282	Exeunt	Physician	Vast
WN283	Exonerate	Pigeon	Veneer
WN284	Expand	Pike	Vest
408	Expect	Pill	Veteran
409	Expedite	Pillow	Vex
410	Expert	Pilot	Vibrate
411	Expire	Pineapple	Victor
412	Explode	Pious	Vigor
413	Explore	Pirate	Vim
414	Extripate	Pitfall	Vine
508	Exhale	Pibroch	Vaunt
509	Exhaust	Picnic	Veal
510	Exhibit	Picture	Vegetate
511	Exhort	Pierce	Velvet
512	Exile	Piety	Venation

Improved Capitol Boilers
25 Series

No.	Steam	Water	Complete Set of Grates
1425	Abate	Alliance	Unabated
425	Ambush	Anvil	Unambushed
1525	Azure	Arctic	Unazured
525	Archive	Anchor	Unarchived
1625	Abdicate	Antarctic	Unabdicated
625	Atlas	Applause	Unatlased
1725	Abduct	Album	Unabducted
725	Alcove	Attic	Unalcoved
1825	Abet	Antler	Unabetted
825	Abandon	Area	Unabandoned

Improved Capitol Boilers
37 Series

1537	Cursory	Curtain	Uncursed
537	Caliper	Cypress	Uncalipered
1637	Camera	Cactus	Uncamed
637	Cycloid	Cabbage	Uncycloided
1737	Camphor	Culvert	Uncamphored
737	Caller	Cabinet	Uncalled
1837	Curvity	Cadet	Uncurvited
837	Cuttle	Cynic	Uncuttled
1937	Candid	Calendar	Uncalendered
937	Camber	Caboose	Uncambered
2037	Canine	Calico	Uncanined
1037	Cutlass	Cackle	Uncutlassed

Furman Sectional Boilers

Size	Complete Set of Grates	Size	Complete Set of Grates
184	Gyrated	279	Gisant
185	Gyration	337	Guipon
186	Gyratory	338	Gunstaf
187	Gyromancy	339	Gymnote
225	Gencive	340	Gulot
226	Genope	387	Glossiness
227	Gerboise	388	Glottal
228	Gerant	389	Glover
276	Gite	390	Glucose
277	Giron	391	Glycerin
278	Grafter		

Furman Round Sectional Boilers

16–0	Glair	22–3	Gimbal
16–1	Glade	25–0	Gypsy
16–2	Guzzle	25–1	Gynarchy
19–0	Glassy	25–2	Gymnast
19–1	Gurgle	25–3	Gypsum
19–2	Gusset	29–0	Gleaner
22–0	Gust	29–1	Gleaming
22–1	Guttural	29–2	Glee
22–2	Gutter	29–3	Gluten

Furman Square Sectional

No.	Steam	Water	Complete Set of Grates
225	Excavate	Pharmacy	Vagrant
226	Exceed	Pharynx	Vain
227	Excelsior	Phase	Valance
228	Exception	Pheasant	Valence

Improved Capitol Boilers

48 Series

Size	Complete Set of Grates	Size	Complete Set of Grates
1748	Unlanced	1048	Unlathered
748	Unlariated	2148	Unlegended
1848	Unleadered	1148	Unlaureled
848	Unlassoed	2248	Unluminated
1948	Unlectured	1248	Unlymphed
948	Unlatented	2348	Unlucrative
2048	Unlegated	1348	Unlutarated

Improved Capitol Solar Boiler

No.	Complete Set of Grates	No.	Complete Set of Grates
702	Dewabbling	1803	Dewhipping
1002	Dewadded	1804	Dewalnutting
1003	Dewafering	1805	Deweeviling
1004	Dewagging	2403	Dewamping
1402	Dewaking	2404	Dewarding
1403	Dewalling	2405	Deweltering
1404	Dewaylaying	3303	Dewarfaring
		3304	Dewariling
		3305	Dewarranting

Sunray Boilers

No.	Complete Set of Grates	No.	Complete Set of Grates
54-E	Jabberer	236	Jessamine
55-E	Jabiru	237	Jealousy
56-E	Jacamar	238	Jelly
57-E	Jacent	239	Jay
95-A	Jacknapes	240	Jumbo
96-A	Jackdaw	WN 276	Jailbird
97-A	Jackplane	WN 277	Jalapin
98-A	Jacobin	WN 278	Jambee
326	Jackonet	WN 279	Japhetic
327	Jaculate	WN 280	Janizary
328	Jadery	WN 281	Japanese
329	Jaggery		
235	Jocund		

Hot Water Supply Boilers

No.	Code	Complete Set of Grates
2X	Ivory	Saloon
119	Insular	Solitaire
120	Intact	Sombre
62	Iterate	Salutary
63	Itching	Salute

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